SACT 2018
The 5th Southeast Asia Conference on Thermoelectrics

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14 - 17 December 2018

Empress Angkor Resort & Spa,
Siem Reap, Cambodia

Organized by:

สมาคมเทอร์โมอิเล็กทริกไทย
Thai Thermoelectric Society

Abstracts Book
SACT 2018

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Welcome Message

It is our great pleasure to invite you to participate in the 5th Southeast Asia Conference on Thermoelectrics (SACT2018), in Empress Angkor Resort & Spa, Siem Reap, Cambodia, on 14-17 December 2018. The series of Southeast Asia Conference on Thermoelectrics (SACT) is promoted by the Thai Thermoelectric Society for favoring the dissemination in Southeast Asia of the scientific and technical progresses in the field of Thermoelectrics, enhancing the communication between research institutions and industries for promotion of TE applications, providing a forum for exchange of information and achievements. Experts, scientists and engineers from Research and Industry all around Southeast Asia and abroad, are all invited and expected for attending the conference and discussing the Thermoelectric Materials & modeling, Thermoelectric Device Development & Testing, Thermoelectric Systems Design and Applications and Other Materials and Applications. All papers will be selected publication in Advances in Natural Sciences: Nanoscience and Nanotechnology (IOP Science), Integrated Ferroelectrics (ISI impact factor = 0.41), Materials Today Proceeding (Scopus), Suranaree Journal of Science and Technology (SCOPUS), Journal of Materials Science and Applied Energy (ACI) and SNRU Journal of Science and Technology (ACI) after peer reviewing. We feel confident that you will enjoy SACT2018 both scientifically and socially and that it will also be a wonderful chance to meet old friends and make new ones, and that the conference will be a memorable event. Looking forward to seeing all of you in Siem Reap, Cambodia, on 14-17 December 2018. Sakon Nakhon Rajabhat University (SNRU) is the institution for higher education and research center for the local area. It is a great pleasure for us to host the “Sakon Nakhon Rajabhat University International Conference 2015 (SNRU IC 2015) which will be held on 24 July 2015 at Sakon Nakhon Rajabhat University, Thailand. This forthcoming conference comprises three sessions namely: Science and Technology; Humanities and Social Science and the East – West Economic Corridor. The conference will enable researchers to open up their study, thoughts and innovation, likewise provide wider opportunities. I am confident that the conference will enhance the quality and reputation of our research, both nationally and internationally.

I hope that this conference will be beneficial to all students, teachers, researchers and those who are interested in these subjects. It is another important step in Science and Technology, Humanities and Social Science and East – West Economic Corridor as well as for country development innovation, likewise in order to stand equally with civilized internationals.

Asst. Prof. Dr. Anek Charoenpakdee
President of Thai Thermoelectric Society

About Conference

Executive Board:

1. Asst. Prof. Dr. Viroj Limkaisang, President of Rajamangala University of Technology Isan
2. Asst. Prof. Preecha Thammavintorn, President of Sakon Nakhon Rajabhat University
3. Dr. Virat Pingkeaw, President of Nakhon Pathom Rajabhat University
4. Assis. Prof. Dr. Anek Charoenpakdee, President of Thai Thermoelectric Society

Organizer:

1. Thai Thermoelectric Society (TTS)
2. Rajamangala University of Technology Isan

Co-Organizers:

1. Center of Excellence on Alternative Energy (CEAE)
2. Research and Development Institute, Sakon Nakhon Rajabhat University
3. Center of Excellence in Glass Technology and Materials Science (CEGM), Nakhon Pathom Rajabhat University
4. Materials Research Society of Thailand (NRS-Thailand)
5. Faculty of Science and Engineering, Kasetsart University, Chalermphrakiat Sakon Nakhon Province Campus (KUSE)

Conference Chair:

Assis. Prof. Dr. Anek Charoenpakdee	President of Thai Thermoelectric Society
Assoc. Prof. Dr. Tosawat Seetawan	Sakon Nakhon Rajabhat University
Assoc. Prof. Dr. Jakrapong Keawkhao	Nakhon Pathom Rajabhat University

SACT2018 Program

Date/Time	Friday December 14, 2018		
Venue: Empress Angkor Siem Reap Resort & Spa			
16.00 – 20.00	**Registration: Royal Conference (4th Floor)**		
Date/Time	**Saturday December 15, 2018**		
08.00-09.00	**Registration: Royal Conference (4th Floor)**		
09.00 – 09.30	**Opening Ceremony: Royal Conference (4th Floor),** *Everybody wear SACT2018 shirt* Welcoming speech by Assoc. Prof. Dr. Tosawat Seetawan and Assoc. Prof. Dr. Jakrapong Keawkao, Conference chairs Welcoming speech by H.E. Sieng Emtotim, Rector of University of Battambang Reporting by Assist. Prof. Dr. Anek Charoenpakdee, President of Thai Thermoelectric Society Opening remarks by Asst. Prof. Dr. Viroj Limkaisang, President of Rajamangala University of Technology Isan		
09.30 – 10.10	**Keynote Speaker: (Keynote_01):** Prof. Dr. Su-dong Park, South Korea		**Chair: Prof. Dr. Rattikorn Yimnirun**
10.10 – 10.40	**Invited Speaker: (Invited_01):** Prof. Dr. Michitaka Ohtaki, Japan		
10.40 –10.50	**Coffee break: Royal Conference (1st Floor)**		
10.50 – 11.20	**Invited Speaker: (Invited_02):** Assoc. Prof. Dr. Supree Pinitsoontorn, Thailand		
11.20 – 11.40	**Invited Speaker: (Invited_03):** Assoc. Prof. Dr. Phan Ban Thang		
11.40 – 12.00	**Invited Speaker: (Invited_04):** Assoc. Prof. Ir. Dr. Mohd Faizul Mohd Sabri		
11.50 – 13.00	**Lunch: Crown Restaurant (1st Floor)**		
13.00 – 13.40	**Keynote Speaker: (Keynote_02):** Dr. Ryoji Funahashi, Japan		**Chair: Assoc. Prof. Dr. Tosawat Seetawan**
13.40 – 14.00.	**Coffee break: Royal Conference (1st Floor)**		
14.00 – 17.05	**Parallel Session**		
	Royal Conference (4th Floor) **Chair:** Assoc. Prof. Supree Pinitsoontorn **(Invited_05)**: Prof. Dr. Hong Joo Kim **(Invited_06)**: Assoc. Prof. Dr. Than Zaw Oo **Oral presentation** AO0005, AO0021, AO0028, AO0029 **Chair:** Assoc. Prof. Dr. Than Zaw Oo AO0055, AO0068, AO0079, AO0080, AO0081	**Royal Hall Conference I (5th Floor)** **Chair:** Prof. Dr. Michitaka Ohtaki **(Invited_07)**: Assoc. Prof. Dr. Bundit Krittacom **(Invited_08)**: Prof. Dr. Jingfeng Tang **Oral presentation** AO0098, AO0104, AO0117 **Chair:** Assoc. Prof. Dr. Phan Ban Thang CO0082, DO0017, DO0023, DO0025, DO0045, DO0115	**Royal Hall Conference II (5th Floor)** **Chair:** Assoc. Prof. Dr. Jakrapong Keawkao **(Invited_09)**: Prof. Dr. C. K. Jayasankar **(Invited_10)**: Prof. Dr. Mitra Djamal **Oral presentation** DO0052, DO0054 **Chair:** Prof. Dr. C. K. Jayasankar DO0070, DO0071, DO0072, DO0074, DO0111, DO0114
17.05 – 17.20	**Company talk:** ULVAC (Thailand) LTD.: **Royal Conference (4th Floor)**		
17.20 – 17.35	**Company talk:** Kinetics Corporation LTD.: **Royal Conference (4th Floor)**		
17.35 – 18.00	**Poster Presentations: Royal Conference (4th Floor)** **Referees:** 1. Prof. Dr. Su-dong Park 2. Dr. Ryoji Funahashi 3. Prof. Dr. Michitaka Ohtaki 4. Assoc. Prof. Dr. Supree Pinitsoontorn 5. Assoc. Prof. Dr. Phan Ban Thang 6. Assoc. Prof. Ir. Dr. Mohd Faizul Mohd Sabri 7. Prof. Dr. Hong Joo Kim 8. Assoc. Prof. Dr. Than Zaw Oo 9. Assoc. Prof. Dr. Bundit Krittacom 10. Prof. Dr. Jingfeng Tang 11. Prof. Dr. C. K. Jayasankar 12. Prof. Dr. Mitra Djamal 13. Prof. Dr. Rattikorn Yimnirun		
18.00 – 18.30	**Free time**		
18.30 – 22.00	**Banquets: Royal Conference (4th Floor)**		
Date/Time	**Sunday December 16, 2018**		
09.00 – 15.30	SACT2018 Workshop and Asian Thermoelectric Meeting		

Oral Presentations

Time	ID No.	Topic/Presenter
Session Presentation; Royal Conference (4th Floor)		
Chairpersons : Assoc. Prof. Supree Pinitsoontorn		
14.00 – 14.25	Invited_05	Growth and Characterization of Single Crystals by Bridgman and Czochalski Method for Various Applications *Prof. Dr. Hong Joo Kim*
14.30 – 14.55	Invited_06	Review on Perovskites Photovoltaic-Thermoelectric Hybrid Devices *Assoc. Prof. Dr. Than Zaw Oo*
14.55 – 15.05	AO0005	Effect of Sb-Doping on the Electronic Structure and Thermoelectric Properties of $TiNiSn_{1-x}Sb_x$ (x = 0 – 0.125) Half-Heusler Alloys *Mr. Meena Rittiruam*
15.05 – 15.20	AO0021	Thermoelectric Properties of $SnSe_2$ Pulk and Thin Film *Dr. Anh-Tuan Duong*
15.20 – 15.35	AO0028	Selection of new Silicides for Thermoelectrics Using Online Database Materials Project *Mr. Sora-at Tanusilp*
15.35 – 15.50	AO0029	Half-Heusler FeNbSb: Stability and Thermoelectric Properties *Miss. Wanthana Silpawilawan*
Chairpersons : Assoc. Prof. Dr. Than Zaw Oo		
15.50 – 16.05	AO0055	Thermoelectric Properties of Heavily Phosphorus-Doped $InSiTe_3$ *Mr. Tawat Suriwong*
16.05 – 16.20	AO0068	Fabrication and Thermoelectric Properties of InSb/Bi Eutectic Alloy by Melt Spinning and Spark Plasma Sintering *Mr. Mohd Natashah Bin Norizan*
16.20 – 16.35	AO0079	Synthesis and Thermoelectric Properties of $Ca_3Co_4O_9$ by Sol-gel and Hot-Pressing Technique *Mr. Anon Angnanon*
16.35 – 16.50	AO0080	Low Electrical Resistivity of Nano WO_3-doped ZnO Thermoelectric Material *Mr. Wasu Cheewasukhanont*
16.50 – 17.05	AO0081	Reliability Test System for the Thermoelectric Power Generation Module *Mr. Seong Joon Heo*

Time	ID No.	Topic/Presenter
Session Presentation; Royal Hall Conference I (5th Floor)		
Chairpersons: Prof. Dr. Michitaka Ohtaki		
14.00 – 14.25	Invited_07	Application of Thermoelectric (TE) Principle on the Cyclic Reversal Flow Combustion of Porous Burner (PB) *Assoc. Prof. Dr. Bundit Krittacom*
14.30 – 14.55	Invited_08	Gas Discharge and its Applications Under Airflow *Prof. Dr. Jingfeng Tang*
14.55 – 15.05	AO0098	Thermoelectric Properties of Al_8Mo_3 *Mr. Kunio Yamamoto*
15.05 – 15.20	AO0104	Thermal Conductivity of $BaSn_{1-x}M_xO_{3-\delta}$ (M = Nb or Ta) Ceramics *Mr. Shimpei Kuwahara*
15.20 – 15.35	AO0117	Thermoelectric Properties of Two-Dimensional Dirac Materials *Dr. Eddwi Hasdeo*
Chairpersons: Assoc. Prof. Dr. Phan Ban Thang		
15.35 – 15.50	CO0082	Thermoelectric Based Temperature Control for QCM Sensor Impedance Measurement *Dr. Setyawan Sakti*
15.50 – 16.05	DO0017	The Kinetics study of Transesterification Reaction for Biodiesel Production Catalyzed by CaO Derived from Eggshells *Dr. Wuttichai Roschat*
16.05 – 16.20	DO0023	Mercury Ions Detection Based on Schiff Base Paper Test Strip Colorimeter Sensor *Miss. Piyawan Leepheng*
16.20 – 16.35	DO0025	Chemical Gas Sensors Based on 2D materials: Ab-Initio Theoretical Study *Dr. Thanayut Kaewmaraya*
16.35 – 16.50	DO0045	Surface Modification of Superparamagnetic Iron Oxide Nanoparticles and Methyl Methacrylate Molecularly Imprinted Polymer for Gluten Detection *Miss. Dalawan Limthin*
16.50 –17.05	DO0115	Fabrication Of P-Type (MCCO) Thin Film Using DC Magnetron Sputtering As A Preparator For Thermoelectric Module *Miss Elysa Nensy Irawan*

Time	ID No.	Topic/Presenter
Session Presentation; Royal Hall Conference II (5th Floor)		
Chairpersons : Assoc. Prof. Dr. Jakrapong Keawkao		
14.00 – 14.25	Invited_09	Influence of Lanthanide Addition on the Optical, Thermal and Electrical Properties of Oxide Glasses *Prof. Dr. C. K. Jayasankar*
14.30 – 14.55	Invited_10	Growth and Characterization of Single Crystals by Bridgman and Czochalski Method for Various Applications *Prof. Dr. Mitra Djamal*
14.55 – 15.05	DO0052	Fluorene Derivative Chemosensors for Cadmium Detection *Miss. Prawonwan Thanakit*
15.05 – 15.20	DO0054	Preparation, Electrochemical and Catalytic Properties of Hybrid ZnO-Protein Nanocomposite *Dr. Wisanu Pecharapa*
Chairpersons : Prof. Dr. C. K. Jayasankar		
15.20 – 15.35	DO0070	The Physical and Luminescent Properties of Dy^{3+} Doped Phosphate Glasses for Solid State Lighting Devices *Mr. Muhammad Shoaib*
15.35 – 15.50	DO0071	Effects of BaO and Bi_2O_3 on the Optical and Luminescence Properties of Dy^{3+} Doped Borophosphate Glasses *Miss. Yaowaluk Tariwong*
15.50 – 16.05	DO0072	Optical and Physical Investigations of CuO Dope in Glasses Prepared from Rice Husk Ash *Mr. Nakarin Singkiburin*
16.05 – 16.20	DO0074	Enhancement of Emission Intensity in Dy^{3+} Doped ZnO/ZnF_2 Phosphoborate Glasses for W-LED Materials *Dr. Piyachat Meejitpaisan*
16.20 – 16.35	DO0111	Fabrication of $Ca_{12}Al_{14}O_{33}$ Mayenite Structure by Spark Plasma Sintering *Mr. Chalermpol Rudradawong*
16.35 – 16.50	DO0114	Effects of Mn Doping on Structure and Electrochemical Properties of $BiVO_4$ Nanoparticles *Dr. Jessada Khajonrit*

Poster Presentations

ID	Topic
Venue : Royal Conference (4th Floor)	
Section A: Thermoelectric Materials & modeling	
AP0009	Effect of milling Techniques on the Particle Characteristics of Conductive Pr-Substituted YBa_2CuO_{7-y} Compound *Mr. Poom Prayoonphokkharat*
AP0010	Enhancing Thermoelectric Properties of p-type SiGe Alloy Through Optimization of Carrier Concentration and Processing Parameters *Mr. Supree Pinitsoontorn*
AP0014	Thermoelectric Performance Evaluation of $FevSb_{1-x}Se_x$ Half-Heusler Compounds Synthesized via Mechanical Alloying and Vacuum Hot Pressing *Mr. Soon-Chul Ur*
AP0020	Synthesis and Thermoelectric properties of Ag-Sb-Te thin films *Mrs. Natchanun Prainetr*
AP0040	Synthesized Transparent Thermoelectric p-Type γ-CuI Thin Film Using Liquid Iodination Method *Mr. Narongsak Posopa*
AP0048	Enhancing Structural, Electrical and Thermoelectric Properties of p-type Antimony Telluride Flexible Films Using Thermal Treatment Via Rapid Microwave-Assisted DC Magnetron Sputtering Technique *Miss. Prasopporn Junlabhut*
AP0062	Thermoelectric Properties of Bulk p-type Cu_2ZnSnS_4 Materials Prepared by Hot Pressing Method *Mr. Nattee Khottummee*
AP0077	Thermoelectric Properties of N-Doped $Ge_2Sb_2Te_5$ Thin Film *Miss. Uthumporn Chanmala*
AP0086	Thermoelectric Properties of Mg-Doped $CuCrO_2$ Materials *Mr. Dung Hoang*
AP0090	Preparation for the Nano Crystallite Size of Thermoelectric CCO-349 by Planetary Ball Mill/Quickly Hot-Press Methods *Miss. Wanatchaporn Namhongsa*
AP0095	Controlling Structural and Thermoelectric Properties of Ga and In Dually-Doped ZnO Ceramics Via Tuning Powder Particle Size and Phase Segregation *Mr. Anh Pham*
AP0102	Modeling and Experimental Study of $CaMnO_2$ TEG Modules *Mr. Keerati Maneesai*

ID	Topic
Venue: Royal Conference (4th Floor)	
Section B: Thermoelectric Device Development & Testing	
BP0002	Electrical Energy Harvesting from Human Heat using Flexible Thermoelectric Devices *Mrs. Urai Seetawan*
BP0004	Oxide Thermoelectric Module Application with the Stove *Mr. Kunchit Singsoog*
BP0094	Fabrication of Thermoelectric Modules by High Pressure Continuous Automatic Machine *Miss. Sunisar Khammahong*
BP0100	Thin Films Thermoelectric Generator of p-AST/n-BT *Mr. Somporn Thaowankaew*
BP0110	The Low-Cost and Accuracy Instrument for Measuring Spin Seebeck Effect *Mr. Poramed Wongjom*

ID	Topic
Venue: Royal Conference (4th Floor)	
Section C: Thermoelectric Systems Design and Applications	
CP0024	Application of Thermoelectric Generator in Incinerator *Mr. kongphope Chaarmart*
CP0032	Hybrid Microwave Solid-State Synthesis Method for Rapid Synthesis of SnTe for the Thermoelectric Material *Mr. Jakrit Gobpant*
CP0058	Fabrication of New Thermoelectric Block Floor for Power Generator *Mr. Sakorn Inthachai*
CP0093	Prototype of Concrete Block Electric Power Generation from Heat and Applications in Municipal Melting Furnace or Municipal Incinerator *Mr. Chaiwat Phrompet*
CP0103	Design and Controller of Thermoelectric Cooler for Turbo Molecular Pump Cooling Applications *Dr. Athorn Vora-ud*
CP0109	Thermoelectric Application with Solution Sensor *Mr. Surasak Ruamruk*
CP0118	Producing Electric from Heat to Renewable Energy Natural Energy Creation House *Mr. Wuttipong Chuenboonchu*

ID	Topic
Venue: Royal Conference (4th Floor)	
Section D: Other Materials and Applications	
DP0003	Comparison Study of Clear Glazes at Different Temperatures from Glass Beer Bottles Waste Used as Glaze Decoration on Ceramic Products *Mr. Nattawut Ariyajinno*
DP0006	Electrical and Sensitivity Properties of ZnO/TiO_2 Heterojunction Nanocomposites for Ammonia Gas Sensor *Miss. Pitchanunt Chaiyo*
DP0007	Highly Ordered Titania Nanotube Arrays Synthesized via One-faced and Single-step Anodization *Miss. Thanaporn Thumsa-ard*
DP0011	Dielectric and Ferroelectric Properties of $(Pb_{1-x}La_x)(Zr_{0.53}Ti_{0.47})O_3$ Ceramics *Mr. Jukkrit Kongphimai*
DP0012	Enhancements of Growth and Metabolites of Indica rice Callus (Oryza sativa L. cv. Pathumthani1) Using TiO_2 Nanoparticles (Nano-TiO_2) *Dr. Sutee Chutipaijit*
DP0013	Nanocarbon Induced Modifications in Morpho-physiogical Characteristics in Rice Plants [Oryza sativa L. cv. Black Jasmine Rice (Hom-nin)] *Mr. Sutichai Samart*
DP0015	Structural, Optical and Electrical Properties of $(CdS)_{1-x}(ZnTe)_x$ Solid Solution Thin Films prepared by Vacuum Thermal Evaporation Method *Mr. Dusit Thueman*
DP0016	Advanced analysis of collagen materials in functional drink products: Particle size and molar mass by Asymmetrical Flow-Field Flow Fractionation *Miss. Warinrampai Uahchinkul*
DP0019	Physicochemical Properties of Biodiesel Product Derived from Lard Oil using Eggshells as a Green Catalyst *Mr. Phongsakorn Pholsupho*
DP0022	Influence of 1.25 MeV gamma irradiation on the dielectric properties of poly (vinylidene fluoride)/barium titanate polymer nanocomposite *Dr. Siritorn Buranurak*
DP0026	Synthesis of $BiFeO_3$ Nanoparticle Prepared by Sol-Gel Method using Aloe Vera *Dr. Chivalrat Masingboon*
DP0027	Synthesize, Characterization and Magnetic Properties of Nanoparticle Nickel Ferrite ($NiFe_2O_4$) by Sol-Gel Method using Aloe Vera *Mr. Wuttichai Wongnarat*
DP0030	Enhancement of Biodiesel Synthesis using Acid Treated Golden apple Snail Shell-Derived CaO as Economical and Green Heterogeneous Catalyst *Mr. Sunti Phewphong*
DP0031	I-V Characteristics of Au/ZnO/Au and Au/Sb-doped ZnO/Au double-Junction Structure *Mr. Wuttichai Sinornate*

ID	Topic
Venue: Royal Conference (4th Floor)	
Section D: Other Materials and Applications	
DP0033	Effect of O_2 Plasma Treatment on Optical Properties of Cu-Doped SnO_2 Thin Films by O_2 Plasma Treatment *Mr. Natthawirot Somjaijaroen*
DP0035	Effect of Milling Speed and time on Ultrafine ZnO Powder by High energy Ball Milling Technique *Mr. Chatchanan Prommalikit*
DP0037	The Influence of Si/Al ratio in Zeolite Y Structure for Methane and Carbon Dioxide Adsorption *Dr. Nopbhasinthu Patdhanagul*
DP0038	Structural and Optical Properties of C-Bi_2O_3 Microrod Synthesized by Hydrothermal Method *Ms. Ruethaithip Wisedsri*
DP0039	Acid Functionalized Silica/Sulfonated Tetrafluoroethylene based Fluoropolymer Composite Membranes for PEMFCs *Dr. Yaowapa Treekamol*
DP0042	Influence of Calcination Temperature on Physical and Electrochemical Properties of MnO_2 Nanoparticles Synthesized by Co-Precipitation Method *Mr. Chokchai Kahattha*
DP0043	Copper K-edge XAS Study of Copper Transformation Behavior During Annealing of Delafossite $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$ *Mr. Noppanut Daichakomphu*
DP0044	The Performance of Synthetic Zeolite Combined with Activated Carbon for Removal of Linuron Herbicides *Mrs. Rujikarn Sirival*
DP0046	Enhanced Visible Light Photocatalytic Activity of TiO_2 Hybrid with Natural Ilmenite Nanocomposites *Mr. Krisana Chongsri*
DP0047	The Method of Sintering Process for Piezoelectric Tape Ceramic *Dr. Prakrong Plainaek*
DP0049	Influence of Anodized Voltage on Topography and Surface Wettability of TiO_2 Nanotubes Fabricated by Electrochemical Anodization *Mr. Chanawee Sattha*
DP0050	Multi state Mn_3O_4 Hausmannite-Carbon Nanocomposites Derived from Carbonization of Nano-Manganese Oxide-Cellulose *Mr. Weerachon Phoohinkong*
DP0051	Effect of Fuel Content on Dielectric and Piezoelectric of KNLNTS Ceramics Prepared by the Combustion Technique *Dr. Krailas Mathrmool*

ID	Topic
Section D: Other Materials and Applications (continue)	
DP0053	Characterization of $BiVO_4$ Nanoparticles Prepared by Sonochemical Process *Mr. Thanaphon Kansaard*
DP0056	Synthesis, Morphology and Optical Properties of Perovskite-Type Oxides $La_xSr_{1-x}FeO_3$ Synthesized by Sol-Gel Auto-Combustion Method *Mr. Tawat Suriwong*
DP0059	Preparation of the $MAPbBr_3$ Perovskite Films by the One-Step Spin Coating Method for Solar Energy Conversion Devices *Dr. Wirat Jarernboon*
DP0060	The Fe_3O_4 Nanoparticles on Heavy Metals Determination Application *Ms. Saiphon Chanpaka*
DP0061	Effectiveness of Composite Materials Between Chitosan and $CaCO_2$ from Animal Shells *Mrs. Pacharee Krongkitsiri*
DP0063	The Organometal Halide Perovskite Films Prepared by DMF Additive in Two-Step Ambient Air Solution Processes *Mr. Soe Ko Ko Aung*
DP0064	Tuning Optical Absorption Property of Core-Shell Structured TiO_2@Ag Nanowire and Nanosphere *Miss. Areeya Kriwongsa*
DP0065	Tuning Optical and Magneto Optical Properties of Core-Shell Structured Fe@Au Nanoparticles *Mr. Thananchai Dasri*
DP0066	Dielectric and Ferroelectric Properties of Piezoelectric Tape PZT-SKN *Miss. Orapan Hemadhulin*
DP0067	Luminescence Properties of Dy^{3+} ions Doped in B_2O_3-Al_2O_3-CaO-Na_2O Glass for Solid State Lighting Applications *Dr. Yotsakit Ruangtaweep*
DP0073	Radiation Shielding of BaO: WO_3: Na_2O:B_2O_3 Glass System by WinXCom Program in the Range of 1 keV to 100 GeV: Theoretical Calculation *Mr. Wuttichai Chaiphaksa*
DP0075	Fabrication and Study on Optical and Photoluminescence Properties of Europium Doped in Borate Glasses *Dr. Kitipun Boonin*
DP0076	Theoretical Calculation of Mass Attenuation Coefficient and Radiation Shielding Parameters of WO_3-TeO_3 Glasses *Miss. Phoorichaya Wiwatkanjana*
DP0078	The Physical and Optical Properties of Glasses from Local Sand in Nakhon Pathom Province *Mr. Watcharin Rachniyom*
DP0085	Comparative Study of physical, Optical and Gamma-Ray Shielding Properties at 662 keV of BaO-La_2O_3-B_2O_3 and BaO-Na_2O-B_2O_3 *Dr. Pruittipol Limkitjaroenporn*

ID	Topic
Section D: Other Materials and Applications (continue)	
DP0091	Phase Transition, Electrical Properties, and Temperature Insensitive Large Strain in [(0.935-x) BNT-0.065BT-xBZT] Lead-Free Piezoelectric Ceramics *Miss. Nantawan Ketwong*
DP0092	Properties of $NaCu_3Ti_3NbO_{12}$ Based-Ceramics Doped with Nanopowders *Miss. Wilai Chomchai*
DP0096	Bioactive Behavior and Piezoelectric Properties of SNCP/xBCZT Composites *Dr. Nuttapon Pisitpipathsin*
DP0097	The Effect of Low current Density on the Hydrophilicity and Surface Properties of the Anodized Films Performed by Two-Step Anodization *Dr. Phanawan Whangdee*
DP0099	Synthesis and Electrochemical Properties of Porous CNF/$LixMnSiO_4$ for Energy Storage Devices *Dr. Sukanya Nilmoung*
DP0101	NiO Films on ITO Substrates Etched by HCl acid for Electrochromic Devices *Dr. Chakkaphan Wattanawikkam*
DP0106	Fabrication of Piezoelectric Flexible on PVDF/CNTs *Mr. Aphisak Kaeopisan*
DP0107	Biomass Derived Carbon Materials for Electrochemical Energy Storage *Dr. Pristanuch Kasian*
DP0108	A Facile Preparation of Cellulose /Zinc Oxide Nanocomposites for Enhancing Photocatalytic Activity *Mr. An Vu*
DP0112	Influence of Compaction Pressure and Sintering Temperature onto the Mechanical Properties and Tribological Property of the Brass 8020 Product made from the Powder Metallurgy Process *Mr. Sompong Piriyayon*
DP0113	Chitosan Extracted from Crab Shells by Reduction of Chemical Substance Technique *Dr. Somtop Santibenchakul*
DP0116	Fabrication, Structural and Magnetic Properties of Cu-doped BiFeO Thin Film *Mr. Tachgiss Jampreecha*

Content

Keynote Speaker

Understanding the real state of Bi_2Te_3 thermoelectric compounds

SuDong Park[a,e1], Jae-Kee Lee[a], Byungki Ryu[a], Gi-Hee Son[a] and Ho-Sung Lee[b]

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Abstract

Recent studies on thermoelectric materials, which have increased greatly, reveal new facts about thermoelectric materials that differ from what we have understood. Even more than 60 years have been studied, and the most representative thermoelectric materials, Bi_2Te_3 compounds, have been reported in new structures, as like meta-state crystalline, and phenomena different from the previous reports, and new attempts to improvement performant based on these have reported.
In this presentation, we will introduce the observed real state mixed meta-states of the Bi_2Te_3 thermoelectric compounds and report how these phenomena occur naturally. We believe that new understanding and interpretation of the thermoelectric material with the meta state as described above can not only help the understanding of the various nanostructures and the mechanism of generation of heterogeneity in the telluride system, but also being the important axis of the new thermoelectric material development strategy. This presentation will briefly introduce KERI's activities on thermoelectric module and thermoelectric power generation system, also.

Keywords: thermoelectric material, Meta-state, Bi_2Te_3

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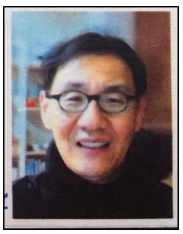

Translational research using high durable thermoelectric modules

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Abstract

Oxide materials are considered to be promising ones because of their durability against high temperature, low cost for producing etc. Thermoelectric modules using p-type $Ca_3Co_4O_9$ and n-type $CaMnO_3$ have been produced. The maximum power density against area of the substrate of the module reaches 4.3 kW m^{-2} at 700 ℃ of the heat source temperature in air. In order to use the thermoelectric modules in practical application, core technologies for the evaluation of the modules are necessary. The evaluation equipment has been developed to measure the durability of the modules in National Institute of Advanced Industrial Science & Technology. The properties of the heat cycling and the continuous power generation can be measured up to 700 ℃ of the hot side temperature in air.

Outstanding durability against high temperature and heat cycles of thermoelectric modules has been demonstrated. No remarkable degradation of the power output has been observed in the continuous power generation test at 700 ℃ of hot side temperature in air. The maximum power output at 600 ℃ of the hot side temperature keeps almost the same value with the initial one after the 1,000 times heat cycling between 100 ℃ and 600 ℃ of the hot side temperature. The vibration test has been carried out in conformity to ISO-16750-3 at room temperature. The maximum power output at 600 ℃ of the hot side temperature is not been changed by the vibration test.

Portable power generation units composed of the oxide thermoelectric module as mentioned above. Water circulation are unnecessary for the units. The units can generate 2–5 W using heat energy with temperature of 300–800 ℃. Lighting, sensing, filming, and transmitting data without cables by thermoelectric conversion using waste heat from industrial furnaces, incinerators, engines of automobiles and ships will be possible. The air cooled thermoelectric units can contribute not only to spread the IoT technology, but also overcome the energy and CO_2.

This research has been supported by Thermal Management Materials and Technology Research Association (TherMAT).

Keywords: thermoelectric oxides, module, evaluation, durability, application

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Invited Speaker

Extremely low thermal conductivity of ZnO thermoelectric oxide doped with Al and Cu

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Abstract

A quite high lattice thermal conductivity of ZnO has limited its *ZT* values below 0.7, in spite of a number of attempts to enhance phonon scattering in the oxide. Very narrow solubility ranges of major n-type dopants such as Al and Ga in ZnO are the principal reason of the difficulties to reduce the thermal conductivity; κ, and to optimize the carrier concentration in the oxide. In this paper, we report an extremely low lattice thermal conductivity of doped ZnO, which is found to occur along with an extended solubility limit on binary doping of Al and Cu in the oxide.
The ZnO samples doped with equimolar amounts (x at. % to Zn) of Al and Cu showed a significant peak shift in their XRD patterns, which has never been observed on single doping of Al, Ga, or Cu. Moreover, the κ values of the sample at x = 8 was as low as 5 and 1.5 W $m^{-1}\cdot K^{-1}$ at room temperature and 800 °C, respectively. By comparing with the κ values of Al-doped ZnO at x = 2 as 40 and 8 W $m^{-1}\cdot K^{-1}$ at the corresponding temperatures, a drastic reduction of κ was obvious. It should also be noted that the κ value at 800 °C is very close to the theoretical lower limit of 1.2 W $m^{-1}\cdot K^{-1}$ for ZnO above room temperature.

Keywords: zinc oxide; thermal conductivity; lattice relaxation; solubility limit; co-doping

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Invited_01

Development of thermoelectric materials based on oxides and silicides

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Abstract

In this talk, I will present my collaborative research with Osaka University (Prof. Ken Kurosaki) on the development of oxides and silicides materials for thermoelectric applications. For oxides, the research interest was focused on the misfit layered calcium cobaltite ($Ca_3Co_4O_9$). With this materials, we have tried easing the synthesis method by using a one-step simple decomposition technique. The single phase of $Ca_3Co_4O_9$ was obtained with decent thermoelectric property values. Furthermore, we tried improving the thermoelectric properties by partial substitution of Co with other transition metals (Cr, Mn, Fe, Ni, Cu, Zn, Ga). The transition metals doped $Ca_3Co_4O_9$ showed the enhanced thermoelectric performance. The synchrotron-based X-ray absorption (XAS) technique was utilized in finding the local structure of the doped $Ca_3Co_4O_9$ and found the preferential sites of each substituted element. Other aspects of $Ca_3Co_4O_9$ materials were also investigated such as magnetic, dielectric and electrochemical properties. For silicides, though in the early stage of our research, we have studied the SiGe-based materials. The thermoelectric properties were enhanced by using a melt spinning fabrication method. In addition, the effect of YSi_2 particle addition in SiGe matrix was investigated. It was found that the thermoelectric properties of SiGe-YSi_2 system could be improved only if the YSi_2 particles were in nanometer range scale. The research on oxides and silicides based thermoelectric materials is very important in terms of the sustainability since the materials are non-toxic, relatively cheap and abundant.

Keywords: Thermoelectric, oxide, silicides

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Invited_02

Strategies for improving thermoelectric performance of Co_4Sb_{12} based skutterudite materials

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Abstract

This paper presents the contribution of In-addition into the $La_{0.25}Co_4Sb_{12}$ skutterudite structure for the improvement of its thermoelectric properties. The $In_xLa_{0.25}Co_4Sb_{12}$ ($0 \leq x \leq 0.5$) samples were prepared through a combination of mechanical alloying followed by spark plasma sintering process. The characterization of phase structure and morphology of the sintered $In_xLa_{0.25}Co_4Sb_{12}$ bulk samples were examined by XRD and SEM-EDS analysis. Rietveld analysis of the XRD spectra indicated that double filling of the skutterudite voids with La and In was successfully achieved. Microstructural analysis also detected the presence of the secondary phase, InSb above x = 0.1, which indicates that the maximum In filling in the voids beyond x = 0.22. This has the impact of significantly improving the thermoelectric performance of the $La_{0.25}Co_4Sb_{12}$ compound, through increase in the electrical conductivity. The electrical behavior changes from semiconducting to semimetallic for In > 0.1, which is likely due to the presence of excess In dopant and InSb secondary phase. Double filling also effectively reduced the lattice thermal conductivity. A maximum ZT value of 1.25 at 789 K was achieved for $In_{0.5}La_{0.25}Co_4Sb_{12}$. Summarily, the addition of In into $La_{0.25}Co_4Sb_{12}$ provides a pathway to improve the overall thermoelectric performance of skutterudites through exploitation of double filling strategy to achieve significant improvement in its electrical conductivity and concurrent reduction of its thermal conductivity.

Keywords:

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Invited_03

Perspective of perovskite photovoltaic -thermoelectric (PV-TE) hybrid devices and performance reliability

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Abstract

At present, perovskites have gained great attention as a solar energy harvesting material due to their desirable photovoltaic (PV) properties. The PV devices can only absorb photon energy around the band gap of photoactive material and the remaining energy is lost as transmission and thermalization loss. Thermoelectric (TE) generator uses the thermal energy from PV device and converts it into electricity through Seebeck effect. Hybridization of PV and TE devices, called PV-TE hybrid devices, efficiently harnesses the solar energy in wider range, thereby improving the conversion efficiency and power output of hybrid devices. Because of being a hybrid device, lossless coupling between PV and TE devices is a key requisite for realization of high efficiency devices. In the present talk, the perspective of Perovskite PV-TE hybrid devices will be presented, and their performance reliability will be discussed.

Keywords:

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Invited_04

Thermoelectric properties of n-type In and Ga dually doped ZnO and p-type Mg-doped $CuCrO_2$ materials

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Abstract

Thermoelectrics is well-known as a green-energy technology that converts directly waste heat to electricity. The $CuCr_{0.95}Mg_{0.05}O_2$ sample was fabricated using solid-state reaction method at 1673 K. From a detailed analysis of X-ray diffraction, we realize that $CuCr_{0.95}Mg_{0.05}O_2$ sample completely crystallizes in form of delafossite structure. As can be seen from FESEM images, the rhombohedral structure (*R-3m*) of $CuCr_{0.95}Mg_{0.05}O_2$ crystal reveals the fine grain size. FTIR and Raman spectra also contribute to prove the existence of delafossite structure in our sample. From Hall measurement results, the hole concentration, mobility and resistivity obtain the value of 9×10^{17} cm^{-3}, 2 $cm^2\cdot V^{-1}\cdot s^{-1}$ and 3 Ω·cm, respectively. Besides, our sample obtains the Seebeck value of 446 $\mu V\cdot K^{-1}$ at room temperature.

In addition, the Ga and In dually-doped ZnO (IGZO) ceramics exhibited the enhancement of thermoelectric properties which was mainly attributed to lower thermal conductivity than 5 W $m^{-1}\cdot K^{-1}$. The systematic comparison between IGZO ceramics fabricated by two different high-temperature sintering processes was carried out. As a result, precursor-powder particle size and phase segregation were demonstrated to control the structural and thermoelectric properties, especially thermal conductivity. The characteristics of phase segregation was clearly shown in the X-ray diffraction (XRD) patterns, which mechanism was explained by the X-ray photoelectron spectra (XPS). The difference of powder particle size leading to the change in crystalline morphology could be observed through the scanning electron microscopic (SEM) micrographs. In addition, the correlation between powder particle size, phase segregation and sintering processes was also discussed.

Keywords: thermoelectric material, n-type In and Ga dually doped ZnO, p-type Mg-doped CuCrO2 materials

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Invited_05

Application of thermoelectric (TE) principle on the cyclic reversal flow combustion of porous burner (PB)

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Abstract

In order to propose the alternative method in generating the electrical power, a concept of thermoelectric (TE) operated on the cyclic reversal flow of the premixed-gas combustion of porous burner is discussed. The definition and thermal porous media based on the Weinberg's principle is firstly explained. The advantage of porous media for enhancement heat transfer mechanism is also presented. For the next topic, the comparison combustion between the conventional (Open free-flame burner, CB) and the porous burner (PB) is reported. The general type of CB is categorized. The benefit of the cyclic reversal flow combustion on PB is proposed. Then, thermoelectric (TE) principle applied in PB is discussed. Several researches related with the TE and PB are represented. Finally, the feasibility for applying the TE on the cyclic reversal flow combustion of PB to generate the electrical power is recommended.

Keywords: Thermoelectric principle, porous burner,cyclic reversal flow, electrical power

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Invited_06

Growth and characterization of single crystals by bridgman and czochalski method for various applications

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Abstract

It is quite demanding effective electricity generation from renewable energy such as solar energy and thermoelectric energy. The other hand, it is very important to detection of radiation such as X-ray, gamma and particle detection. In a physics point of view for material development, it shares many common points. In this presentation I will present principle of band gap, crystal formation followed by crystal growth and characterization method.

I will show a couple of examples of our study on new crystal scintillation materials and semiconductor crystals as well as thermoelectric crystal. I will focus more on our work on the new single scintillation crystal growth and characterization for radiation detection by using both Bridgman and Czochalski technique. It could be applied to various scientific and industrial field such as radiation monitoring at nuclear power plants, environmental radiation monitoring, medical imaging such as CT, SPECT and PET, homeland security, astrophysics, nuclear and high energy physics research, non-destructive testing and oil exploration.

Keywords: Termpelectric, semiconductor, cintillator, luminescence, optical materials

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Invited_07

Influence of lanthanide addition on the optical, thermal and electrical properties of oxide glasses

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Abstract

Currently, glass matrices are being widely used in modern society due to its exceptional physical, chemical, thermal, mechanical, electrical and optical properties. On the other hand, lanthanide doped glasses play vital role due to their various applications in diverse fields in modern Science and Technology such as transparent electrical shielding sheets in display panels, near-infrared and visible optoelectronics, medicine, optical reading, atmospheric sensing and eye-safe laser radar and solar cells. In spite of significant progress has already been made, unfortunately, till date, there is no systematic relation between composition of the host matrix versus concentration of lanthanide ion and quantitative electrical, thermal, mechanical and spectroscopic properties in a predictive way. Hence, our group prepared a variety of lanthanide based oxide glasses and glass-ceramics and characterized their thermal, electrical, mechanica and optical properties systematically and uniformly. It has been found that the lanthanide addition is an effective way for tuning and tailoring the required properties for specific applications. The detailed analysis of the results obtained by using various theoretical models and optimization of the ion concentration, glass composition and quantitative parameters by using variety of techniques would be shared in my talk to advance further studies for the development of lanthanide doped glasses for multifunctional applications.

Keywords: Lanthanide doped oxide glasses, optical properties, thermal properties, electrical shielding

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Invited_08

Gas discharge and its applications under airflow

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Abstract

Atmospheric pressure discharges are widely used in active airflow control, material synthesis and air treatment. The key to an optimal application performance lies in how to generate stable and diffuse plasma especially in a large volume and in high-speed airflows. This chapter presents the study of repetitive nanosecond volume discharges under high-speed airflows. The volume discharge strongly depends on the airflows and the corresponding discharge modes vary from filament to diffuse modes with addition of airflows. The role of airflows provides negative effects on discharge currents as well as discharge densities. Moreover, a type of discharge device with upstream and downstream structure is proposed to demonstrate that charged particles produced by the upstream discharge are transported to the downstream zone, play a pre-ionization and enhanced effect to the downstream discharges.

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Invited_9

Fabrication, characterization and simulation of grating-based structures for surface – enhanced raman spectroscopy (SERS) substrates

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Abstract

Surface Plasmon Resonance (SPR) is a resonance phenomenon between electron on the metal surface and the incident light which generates quantized-plasmons oscillation. There are several approaches to excite SPR wave, i.e. by using a prism coupler, grating-based structure, waveguide coupling and nanoparticles. Among those methods, diffraction grating offers more simplicity in fabrication and cost-effective. This paper presents the experimental results on the fabrication of grating-based structure and characterization in those fabricated grating. The fabricated structure is also analyzed using Rigorous Coupled-Wave Analysis (RCWA) method to maximize the SERS electromagnetic field as SERS substrates. SERS substrates are a method to enhance Raman signal.

Keywords: Surface-enhanced Raman spectroscopy, grating-based structure, surface plasmons resonance, rigorous coupled wave analysis

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Invited_10

Oral Presentations

Effect of Sb-doping on the electronic structure and thermoelectric properties of $TiNiSn_{1-x}Sb_x$ (x = 0 – 0.125) half-Heusler alloy

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Abstract

Previous studies report possible enhanced thermoelectric property of $TiNiSn_{1-x}Sb_x$ as compared TiNiSn. To study the effect of Sb-doping on the electronic structure and TE properties of TiNiSn, we performed density functional theory (DFT) based total energy calculations and on top of that we also performed Boltzmann transport calculations. TiNiSn has a total valence electron count of 18, i.e., (Ti:[Ar]$3d^2 4s^2$, Ni:[Ar]$3d^8 4s^2$, Sn:[Kr]$4d^{10} 5s^2 5p^2$) with the molecular orbital formula $Ti^{4+}(NiSn)^{4-}$. TiNiSn thus exhibits non-magnetic semiconducting features, with a narrow energy gap. Replacing Sn with Sb([Kr]$4d^{10} 5s^2 5p^3$) introduces one unpaired electron into the half-Heusler primitive cell. We found that Sb gives an electron to TiNiSn and increases the electron pocket, which in turn increases the electrical conductivity. But the Seebeck coefficient decreased. In the above room temperature operating range, thermal electron contributions dominate over phonon contributions. Our results suggest a maximum power factor of ~1.3×10^{-3} $Wm^{-1}K^{-2}$ at 800 K for Sb-doping concentrations of $x < 0.03$.

Keywords: Density functional theory, boltzman transport, half Heusler alloys, $TiNiSn_{1-x}Sb_x$

AO0005

Thermoelectric properties of $SnSe_2$ bulk and thin film

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Abstract

In the layer structure materials family, $SnSe_2$ has hexagonal crystal structure of the type CdI2 with $P\bar{3}m1$ space group which is characterized by a van der Waals bounding force between Sn-Se-Sn layers along c-axis direction. It was identified as an n-type semiconductor with indirect band gap of 0.97 eV. Recently, thermoelectric properties of $SnSe_2$ has been attracting many researchers due to its ultra-low thermal conductivity. Some theoretical calculations have predicted that thermoelectric properties of $SnSe_2$ strong dependent on carrier concentration. ZT value of $SnSe_2$ single crystal can be achieved up to 2.95 with carrier concentration of 10^{20} cm^{-3}. Here, we report some results about thermoelectric properties of $SnSe_2$ bulk and thin film. Bulk single crystal of $SnSe_2$ was fabricated by gradient temperature method while thin film was grown by PLD method using bulk single crystal as a target. Both bulk and thin film showed hexagonal structure with n-type semiconductor behavior. Carrier concentration at room temperature of bulk is 1.37×10^{18} cm^{-3} while that of thin film is 5.8×10^{19} cm^{-3}. Highest thermoelectric power factor of bulk single crystal which was obtained along ab-plane directions at 673 K is 3.43$\mu W\cdot cm^{-1}K^{-2}$ while PF_{Max} of thin film is 8 $\mu W\cdot cm^{-1}K^{-2}$ at 220 K. An ultralow thermal conductivity (κ_c= 0.43 W m^{-1} K^{-2}) was obtained along c-axis of $SnSe_2$ bulk single crystal at 673 K.

Keywords: Thermoelectric, single crystal, tin diselenide, anisotropy, n-type, low thermal conductivity

AO0021

Selection of new silicides for thermoelectrics using online database materials project

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Abstract

The state of art thermoelectric (TE) materials, such as PbTe and Bi_2Te_3, are composed of toxic, expensive, rare elements, resulting in limited usage in TEs. Si is a non-toxic, cost effective and abundant element, which is suitable for mass production and new market opportunities. However, Si exhibits high thermal conductivity, resulting in relatively low TE performance. On the other hand, several well-known silicides (higher manganese silicide and magnesium silicide) are established as good TE materials. In this study, we search for new silicides for TEs by screening online database Materials Project [A. Jain, S. P. Ong et al., APL Materials, 2013, 1(1), 011002]. Based on the screening result, we select several promising candidates. The selected materials are synthesized and characterized.

Keyword : thermoelectric, silicide, screeing, materials project

AO0028

Half-Heusler FeNbSb: stability and thermoelectric properties

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Abstract

Half-Heusler (HH) compounds are prominent thermoelectric (TE) materials, however the high-temperature stability is scarcely reported. Among the *p*-type HH compounds, FeNbSb exhibits the best TE properties [1]. Recently, our group has revealed that FeNbSb has good high-temperature stability [W. Silpawilawan et at., J. Mater. Chem. C, 2017, 5, 6677-6681]. However, the high-temperature stability of doped FeNbSb is unknown. Here, the effect of element substitution (Ti, Zr, Hf) at the Nb-site of FeNbSb on the TE properties as well as high-temperature stability is examined. Polycrystalline samples of $FeNb_{0.9}M_{0.1}Sb$ (*M* = Ti, Zr, Hf) were prepared by arc-melting followed by spark plasma sintering. The high-temperature stability was checked by high-temperature X-ray diffraction (HT-XRD) from room temperature to 800 °C in both air and He atmosphere. It is revealed that the substitution of Ti, Zr and Hf enhances the TE properties and does not deteriorate the high-temperature stability of FeNbSb.

[1] C. Fu *et al.*, *Nat. Commun.* 6 (2015) 8144.

Keywords: Thermoelectric, high-temperature stability, half-Heusler alloy

AO0029

Thermoelectric properties of heavily phosphorus-doped $InSiTe_3$

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Abstract

It is well known that an intrinsically layered structure is to present low partially localized frequency phonon modes, low sound velocities, and large phonon anharmonicities, which lead to a very low thermal conductivity (κ) due to its strong intralayer chemical bonds and very weak interlayer bonds (van der Waals type). Indium tellusilicate ($InSiTe_3$) compound is one of lamellar transition metal chalcogenides with metal tellusilicate family ($MSiTe_3$). This compound has an intrinsically layered structure with hexagonal symmetry (space group: *P*–*3*). This is the first report of a study of thermoelectric (TE) properties of lamellar undoped and doped indium tellurosilicate ($InSiTe_3$). Heavily phosphorus (P) was selected as an electron dopant. The starting samples were set as $InSi_{1-x}P_xTe_3$ (x = 0.0, 0.02, 0.04, 0.06 and 0.1) and were successfully synthesized by direct reaction in sealed evacuated silica tube. Phase and microstructural characterization revealed the presence of the layered $InSiTe_3$ structure with hexagonal crystal system. The Seebeck coefficient (*S*), electrical resistivity (ρ) and thermal conductivity (κ) of the samples were investigated over the temperature ranging from 323 to 723 K. All the samples exhibited negative *S* value. The ρ was gradually decreased by P-doping with a slight effect on the κ. The power factor also increased with increasing both the temperature and P-dopant contents. The ZT of P-doped $InSiTe_3$ was larger than that of the undoped-$InSiTe_3$ over the whole temperature ranges. In particular, the $InSi_{0.9}P_{0.1}Te_3$ exhibited the best TE performance and a maximum ZT value of 0.14 at 723 K, which is about fourteen times larger than that of the undoped $InSiTe_3$. Optimization of the carrier concentration through heavily P dopant further enhances the TE performance of the lamellar $InSiTe_3$. The results suggest that P-doped $InSiTe_3$ can be a good n-type TE material.

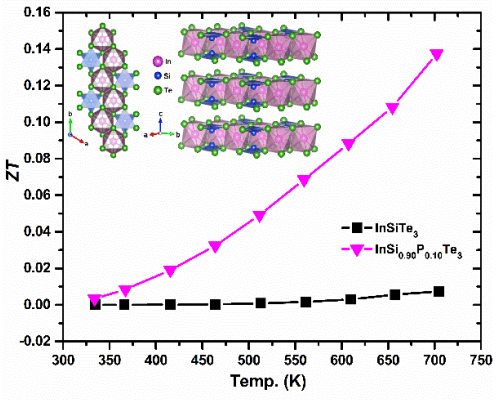

Fig. 1. Temperature dependences of dimensionless figure of merit (ZT) of the $InSi_{1-x}P_xTe_3$ (x = 0.0, 0.02, 0.04, 0.06 and 0.1)

Keywords: $InSiTe_3$, tellurosilicate; thermoelectric, seebeck coefficient, electrical resistivity, thermal conductivity

AO0055

Fabrication and thermoelectric properties of InSb/Bi eutectic alloy by melt spinning and spark plasma sintering

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Abstract

Bismuth is a semimetal and the alloy is one of the most attractive thermoelectric materials in a low temperature region. In the present study, Bismuth-Indium Antimonide eutectic alloy has been synthesized by combining melt spinning technique with spark plasma sintering and its thermoelectric properties are characterized. The alloy was composed by pure bismuth and InSb. Thermoelectric properties can be adjusted and optimized and ZT value can be improved effectively by controlling the microstructure. This fabrication technique using the eutectic reaction is considered as a promising method for preparing nanostructured bulk thermoelectric materials.

Keywords: Thermoelectric materials, melt spinning, spark plasma sintering, eutectic composition, bismuth

AO0068

Synthesis and thermoelectric properties of $Ca_3Co_4O_9$ by sol-gel and hot pressing technique

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Abstract

The Calcium Cobalt Oxide ($Ca_3Co_4O_9$) nanopowders were synthesized by a Sol-gel method using calcium nitrates ($Ca(NO_3)_2{\cdot}4H_2O$) and cobalt nitrates ($Co(NO_3)_2{\cdot}6H_2O$) raw materials. The nanopowder was grinded by mortar for 2 h in air and optimized to achieve highly pure and fully dense pellets by hot pressing method at 900 °C 1 h in Ar atmosphere. The sample was aneanled by furnace 900 °C 12 h in air at after hot pressing. The crystal structure of sample was analyzed by X-ray diffraction technique and compared with literature review data. The electrical resistivity, Seebeck coefficient and power factor of the sample were measured and evaluated by ZEM-3 at room temperature to 600 °C. It was found that the crystal structure $Ca_3Co_4O_9$ shows tetragonal structure correspond with literature data, a = b = 0.4646 nm and c = 1.0818 nm. The highest power factor value of $Ca_3Co_4O_9$ is 0.18 mW $m^{-1}{\cdot}K^{-2}$ at 600°C.

Keyword: $Ca_3Co_4O_9$, sol-gel, hot pressing

AO0079

Low electrical resistivity of nano WO_3-doped ZnO thermoelectric material

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Abstract

The ZnO thermoelectric material was reduced electrical resistivity by doping nano WO_3 powder in solid-state reaction process. The electrical resistivity, resistivity and Seebeck coefficient were measured by ZEM-3 at temperature range of 373– 873 K in Ar atmosphere. The results found that the XRD patterns did not show evidence for WO_3 inclusion into the ZnO lattice, but the SEM showed an intensive distribution of WO_3 into the grain boundaries. The average Seebeck coefficient of WO_3-doped ZnO sample was increased from −30 to −75 $\mu V \cdot K^{-1}$ indicate n-type thermoelectric materials. Moreover, we can reduce the electrical resistivity ranged from 16 μΩ.cm to 34 μΩ.cm. The highest power factor of sample is 0.024 m W $m^{-1} \cdot K^{-2}$ at 473 K. The results revealed that doping nano WO_3 with ZnO also could promote to using for the thermoelectric devices at high temperature application.

Keyword: ZnO themoelectric materials, Seebeck coefficient, thermoelectric power factors, electrical conductivity

AO0080

Reliability test system for the thermoelectric power generation module

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Abstract

To evaluate the reliability of thermoelectric generating modules it is essential to measure power and resistance changes under the temperature changing condition. For the practical durability test, the difference of temperature between the hot side and the cold side should be kept more than 500 ℃. Also, the hot side temperature should be controlled up and down and the cold side temperature should be stable during the thermal cycle test. Especially in case applying TEG to vehicles which the exhaust gas temperature is fluctuated rapidly from low to high temperature, the heating and cooling time to should be controlled and the hot side temperature reaches target point very quickly.

In this research, the thermoelectric module reliability evaluation system is introduced which simulate real temperature change condition. The Thermal cycle test profile was developed based on the exhaust gas temperature of passenger car under the real civil driving condition and the industrial generator natural gas engine gas temperature. The test profile temperature is adjustable, and the hot side can be heated up to 600 ℃ and cooled under 100 ℃ in 5 minutes with forced air cooling system while the cold side temperature can be maintained at 30 ℃ respectively. That can reduce the test cycle time for the high temperature operating TEGs so that researcher and company can estimate and guarantee module performance easily. The contact force is set up by the mechanical loader and during the test cycle, generated power and resistance are recorded and displayed continuously.

To verify the test system performance, thermal cycle tests based on the automobile exhaust gas temperature were performed with several TEG. The test result, the relationship between power output, resistance and thermal cycle time, shows the stability of temperature control system and the reliability evaluation system design adequacy.

Keywords: Reliability;Cycle Time; Generation Performance; Waste Heat Temperature; TEG

Thermoelectric properties of Al_8Mo_3

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Abstract

As an energy conservation technique, thermoelectric conversion has attracted attention in recent years. It can convert waste heat to electric energy without emitting carbon dioxide. However, it is difficult to put into practical use on a large scale since existing high performance thermoelectric materials contain highly toxic or rare elements. In the present study, Al_8Mo_3 is focused as a new environmentally conscious thermoelectric material. According to the results of first principles calculation and transport properties prediction, Al_8Mo_3 is a pseudo-gap material and promising as the thermoelectric material. The power factor may exceed 2.0×10^{-3} W $m^{-1}\cdot K^{-2}$when the carrier concentration is around 1.0×10^{21} cm^{-3}, assuming that the relaxation time is 1.0×10^{-14} s. A single phase n-type Al_8Mo_3 sample was experimentally prepared by arc melting and spark plasma sintering. Furthermore, a part of Mo site was substituted with other elements in order to optimize the carrier concentration. Large Seebeck coefficient was obtained as predicted.

Keywords: Thermoelectric materials; Al_8Mo_3

Thermal conductivity of $BaSn_{1-x}M_xO_{3-\delta}$ (M = Nb or Ta) ceramics

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Abstract

La-doped bulk $BaSnO_3$ single-crystals exhibit exceptionally high room temperature electron mobility (μ = 320 $cm^2 V^{-1}s^{-1}$) and electrical conductivity ($\sigma = 4\times10^3$ S cm^{-1}) even at a carrier concentration of 8×10^{19} cm^{-1} together with a wide band gap of 3.1 eV [H. J. Kim, *et al*., *Appl. Phys. Express*, 2012, **5**, 61102-1–3.]. Due to these characteristics, $BaSnO_3$ is promising as a *n*-type thermoelectric (TE) material. In the present study, we synthesized Nb- or Ta-doped $BaSnO_3$ ceramics and evaluated the thermal conductivities. The doped samples were synthesized by solid state reactions, using stoichiometric mixtures of high-purity powders of $BaCO_3$, SnO_2, Nb_2O_5, or Ta_2O_5, where the nominal compositions were set as $BaSn_{1-x}M_xO_3$ (M = Nb or Ta, x = 0.05 0.10 0.15 0.20). The deficient $BaSn_{1-x}M_xO_{3-\delta}$ were directly obtained from the spark plasma sintering (SPS) where the reducing atmosphere naturally occurred by the carbon dice. The lattice parameters of $BaSn_{1-x}Nb_xO_{3-\delta}$ and $BaSn_{1-x}Ta_xO_{3-\delta}$ increased almost linearly with increasing the doping level, then remained constant at x = 0.10 and x = 0.15, respectively. After the solubility limit, peaks for Ba_2SnO_4 were observed in the powder XRD patterns of both the Nb- and Ta-doped samples. The thermal conductivity of $BaSn_{0.95}Nb_{0.05}O_{3-\delta}$ was clearly lower than that of $BaSn_{0.95}Ta_{0.05}O_{3-\delta}$, caused by its small speed of sounds and large amount of oxygen vacancy, Sn^{2+} and lone pair electrons ($5s^2$) of Sn compared with those of $BaSn_{0.95}Ta_{0.05}O_{3-\delta}$.

Keywords: thermoelectric materials;thermal conductivity;ceramics; lone pair electrons; spark plasma sintering

AO0104

Fabrication of p-type (MCCO) thin film using dc magnetron sputtering as a preparator for thermoelectric module

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Abstract

Today, thermoelectrics have not been much developed, especially thermoelectrics that use thin film. Based on existing research, the efficiency of thermoelectrics can be developed through the type of material used. In this study, the material used is $CaCO_3$ doped with Mn and Co_2O_3 so that the material $CaCo_{3.5}Mn_{0.5}O_9$ is formed as the p-type target material from thermoelectric while the substrate used is glass. The stages in conducting this research are material synthesis, sputtering using DC Magnetron Sputtering machines to form the thin film, and testing. The synthesis process includes several stages such as grinding, calcination, and sintering. Grinding is done using a Ball Mill machine with a rotation speed of 250 rpm for 2.5 h. Furthermore, the calcination step was carried out by heating the sample to the furnace at 850 °C for 10 hours while the sintering step was carried out at 1250 °C for 5 h. After the synthesis process is complete, a sputtering process is performed using a DC Magnetron Sputtering machine around 10 min. The gas used in this study is Argon gas (Ar). The principle of the sputtering process is that the Ar atom will pound the target material ($CaCo_{3.5}Mn_{0.5}O_9$) so that the electrons from the target will bounce and envelop the substrate to form a thin film. After the sputtering process, several tests were carried out, such as XRD testing to determine the type of crystal, testing ZEM-3 to determine the Seebeck and resistivity coefficients, the thickness of the thin layer formed, and the power factor test to determine the maximum voltage and power generated by the module formed. The result of power factor testing is 1×10^{-2} mW $m^{-1}\cdot K^{-2}$ at 100 °C, 1×10^{-2} mW $m^{-1}\cdot K^{-2}$ at 200 °C and 35×10^{-3} mW $m^{-1}\cdot K^{-2}$ at 300 °C and the thickness is 90 and 34 nm.

Key words: DC Magnetron Sputtering, thermoelectric, thin film

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DO0115

Thermoelectric properties of two-dimensional dirac materials

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Abstract

We performed Boltzmann transport calculation to obtain the Seebeck coefficient, electrical conductivity, electronic thermal conductivity and thermoelectric figure of merit (ZT) for Dirac systems. We found an enhancement of ZT due to the gap opening. When the phonon thermal conductivity is small enough, the optimum ZT in gapped Dirac system can be larger than 1, which is preferable for thermoelectric applications.

Keywords: Graphene, transition metal dichalcogenides, dirac materials, thermoelectrics

AO0117

Thermoelectric based temperature control for QCM sensor impedance measurement

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Abstract

Temperature stability was one crucial point in the Quartz Crystal Microbalance (QCM) sensor measurement in liquid environments such as its application for biosensor and chemical sensor. The QCM sensor has a sensitivity to the viscosity and density change of the liquid in contact with the sensor. Therefore, the QCM sensor was also developed as a viscosity measurement instrument. In such an application, the temperature needs to be controlled to be maintained in the same value along with the measurement process. The temperature control was needed as the liquid viscosity and density depends on its temperature. In the impedance measurement of the QCM sensor in contact with liquid, the temperature needs to be maintained in its constant value. Traditional control using a circulating water bath required much energy to control and also to have a slow response due to the thermal capacity of the water in the water bath. In this work, the thermoelectric element was used to maintain the temperature of the sensor and the liquid being measured. Four thermoelectric modules were used and independently controlled to provide a temperature profile to the QCM sensor module. The temperature of the thermoelectric surface was measured using a thermistor to be used as a closed loop control to drive the thermoelectric current. Temperature distribution was measured using thermal camera and thermistor. The result shows that the temperature stability of the QCM sensor chamber and liquid can be maintained with temperature stability of less than 0.5 °C. Temperature variation of the chamber was done by controlling the current to the thermoelectric both for cooling and heating. This method allows the temperature change of the liquid sample on top of the QCM sensor at 0.05 °C min^{-1} at still air.

Keywords: Thermoelectric, temperature Control, temperature distribution

The kinetics study of transesterification reaction for biodiesel production catalyzed by CaO derived from eggshells

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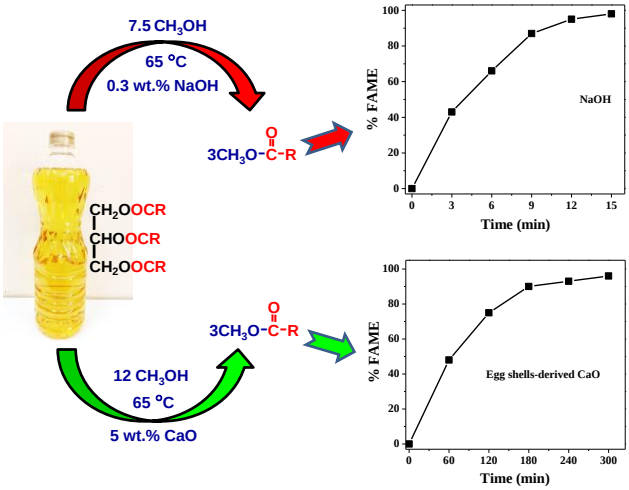
Abstract

The kinetics study of transesterification reaction for biodiesel production catalyzed by CaO derived from eggshells as a solid heterogeneous catalyst compared with NaOH as a homogeneous catalyst was investigated. The results showed that eggshells as calcium carbonate ($CaCO_3$) phase no activity transformed palm oil to fatty acid methyl ester (FAME), while CaO of eggshells displayed highly active catalyst for biodiesel production. Nevertheless, the rate constant of the reaction (k) catalyzed by CaO obtained from eggshells (1.22×10^{-2} min^{-1}) was lower than k value of NaOH catalyst (2.65×10^{-1} min^{-1}) approximately 22 times. Although, CaO of eggshells demonstrated lower catalytic performance than NaOH, they were also advantages than NaOH catalyst such green, low-cost, non-toxicity and reused several times. Furthermore, the comparison catalytic activity of CaO catalyst derived from natural waste materials such as river snail shells, cockel shells and golden apple snail shells versus eggshells derived CaO catalyst was also investigated in this study. All of the results were not only usage as database to develop biodiesel production, but it also illustrated the benefits of waste eggshells and natural waste sources as a material precursor for preparing green catalyst to produce biodiesel product.



Graphical Abstract

Keyword: Kinetics, biodiesel production, transesterification reaction, eggshells, CaO catalyst

DO0017

Mercury ions detection based on schiff base paper test strip colorimeter sensor

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Abstract

The Hg^{2+} is one of heavy metals usually used in batteries industry, agriculture applications as insecticides and medical applications as dental amalgam that Mercury contaminated environment cab be taken into the body via water, air and food daily basis, which caused toxicity in human and organisms. The schiff base is an organic compound in imine functional group, that can be used to detect metal ion using its because it has multi-ligand properties, high binding for d- and f-block metals. In this work, the schiff base was synthesized by 1,2,4-Thaidiazole-3,5-diamine and salicylaldehyde by reflux condensation method with mol ratio 1:2. The synthesized schiff base can immobilized on paper and apply to paper test strip colorimeter sensor for Hg^{2+} ions detection. The selectivity and other optical properties of synthesized schiff base with Hg^{2+} ions were measured by UV-visible spectroscopy and NMR spectroscopy. The paper test strip can detect Hg^{2+} ions concentration in range 2 ppm to 20 ppm. It has high accuracy, inexpensive, easy to use, fast response and colors can see with naked eye.

Keywords: Schiff base, Hg^{2+}detection, paper stripped

DO0023

Chemical gas sensors based on 2D materials: Ab-initio theoretical study

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Abstract

Efficient chemical gas detection has become important for a wide range of applications (such as air quality testing, leakage monitoring of hazardous or explosive gases in industrial safety systems). Innovative nanomaterials are at the forefront of this aspect because of their maximized surface-to-volume ratio that can intrinsically facilitate superior performances to conventional transition-metal oxides sensors. Additional interests have also expanded to atomically thin two-dimensional (2D) materials due to the desirable benefits such as the rapid carrier mobility, the unique planar morphology that enlarges the reactive gas-sensing area, superior mechanical stability and the room-temperature operation. In this talk, the chemical sensors based on 2D materials (i. e., silicene, germanene and phosphorene) to detect selected important gases are presented from the theoretical approaches within the framework of density functional theory. The deciding fundamental information associated with sensing functionality (i. e., detection mechanism, binding energy and changes of electronic properties upon gas exposure) is comprehensively discussed. In addition, the plausible techniques to tailor the sensing performances towards particular kinds of gases are also provided.

Keywords: 2D materials, chemical gas sensors, density functional theory

Surface modification of superparamagnetic iron oxide nanoparticles and methyl methacrylate molecularly imprinted polymer for gluten detection

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Abstract

Gluten is a protein found in cereal grain such as wheat, barley and rye. A small amount of gluten causes an autoimmune disease that lead to damage in the digestive system as well as skin body system. The detection of gluten in food is tremendous attention. Surface modification by molecularly imprinted polymers electrode has been studied specific detection of gluten using electrochemical Superparamagnetic iron oxide nanoparticles were trapped into polymer matrix to improve gluten sensitivity with magnetic property. Gold screen-printed electrode was modified by the magnetic molecularly imprinted polymers using surface polymerization of methyl methacrylate as monomer and gluten as template. The magnetic iron oxide with particle size less than 100 nm was modified and characterized using VSM, DLS and TEM techniques. The surface morphology of gold screen-printed electrodes modified with the MMIP was confirmed by SEM techniques. Finally, MMIP electrodes was used to detect gluten by electrochemical technique.

Keywords: electrochemical technique, magnetic molecularly imprinted polymers, gluten detection, gold screen-printed electrode

DO0045

Fluorene derivative chemosensors for cadmium detection

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Abstract

Fluorescence chemosensors of fluorene derivatives contain the different conjugated aromatic rings and binding sites. The structure of the two fluorene molecules indicate maximum fluorescence spectra at 455 nm and 505 nm for FL(1) and FL(2) in dimethylformamide, respectively. The emission color is sensitive to changes in pH which explains in twisted-intramolecular charge transfer and results in sensitivity to metal ions. At pH 6, these molecules are sensitive to Cd(II) ions which illustrates red-shifted fluorescence spectra and the increase of Cd(II) ions concentration results in the increases of the fluorescence intensity. The limit of detection (LOD) of Cd(II) ions is 0.357 mg L^{-1} of FL(1) and 0.289 mg L^{-1} of FL(2). The presence of other metal ions in Cd(II)-chemosensors solution shows the selectivity for Cd(II) ions and was not significantly sense to other metal ions. The effect of anion was not affect the signal fluorescence intensity when the sensor detects to Cd(II) ions. The Cd(II)-chemosensors complex was characterized using ^{1}H NMR and FTIR spectroscopy. The carboxylic binding sites of fluorene derivative chemosensor is important to interact with Cd(II) ions in dimethylformamide solvation and the cyano moiety can withdraw the charge transfer to binding site results in fluorescence intensity increasing. In addition, superparamagnetic iron oxide nanoparticles were used to improve signal fluorescence intensity for Cd(II) detection which leads to the lower limit of detection.

Keywords: Fluorene derivative, fluorescence chemosensor, cadmium detectio, superparamagnetic iron oxide nanoparticles

Preparation, electrochemical and catalytic properties of hybrid ZnO-protein nanocomposite

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Abstract

In this present work, preparation of ZnO-protein bionanocomposite was carried out starting from commercial zinc oxide nanoparticle and protein that was extracted from swine wool keratin. Fourier-transform infrared spectroscopy (FT-IR), X-ray Photoelectron Spectroscopy (XPS) and field emission scanning electron microscope (FESEM) were employed to study protein structure, chemical bonding environment and surface structure and morphology of the prepared samples. Existence of extracted protein adhered onto zinc oxide surface can be affirmed by protein moieties IR characteristic of methylene and amide. The result indicates that protein COO- and N-H groups can have strong bonds with Zn atom of zinc oxide surface accompanying Zn-S binding formation, hydrogen bond and ionic interaction between protein chain and zinc oxide surface. The adsorbed protein corona conformation and chemical bonding interaction strongly depend on the protein concentration. The crucial properties of the prepared hybrid composite samples were also investigated by electrochemical cyclic voltammetry (CV) and visible light photocatalytic activity properties.

Keywords: Keratin, protein zinc oxide, hybrid nanocomposite

The physical and luminescent properties of Dy^{3+} doped phosphate glasses for solid state lighting device

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Abstract

Phosphate based Oxyfluride glass doped with Dy^{3+} were prepared by melt quenching technique and study through physical, optical and luminescent properties. The density of the prepared glass samples was measured with Archimedes principle. The density and refractive index increase with Dy_2O_3 concentration while the molar volume decreases. The UV-Vis-NIR absorption spectra were recorded in the 200 to 2500nm wavelength range. Eight clear peaks observed centered at 382,449,748,805, 896, 1084, 1266 and 1667 nm corresponding to transitions from ground state $^6H_{15}$ to excited states $^4F_{7/2}$, $^4I_{13/2,}$ $^6F_{3/2,}$ $^6F_{5/2,}$ $^6F_{7/2}$, $^6F_{9/2}$ $^6F_{11/2}$ + $^6H_{9/2}$ and $^6H_{11/2}$ respectively. Photoluminescence excitation and emission spectra have been recorded under 573 and 350 nm wavelength respectively. The intensity of the peaks identifies in the excitation and emission spectra increase with increasing concentration of Dy^{3+} ions up to 1mol% and thereafter decrease. The JO theory is applied to find the JO intensity parameters $\Omega_\lambda(\lambda = 2,4,6)$. JO intensity Parameters show $\Omega_2 > \Omega_4 > \Omega_6$ trend. The radiative properties like transition probability (Ar), stimulated emission cross section (σ_{cal}) and branching ratio (B_r) has measured for our glass samples. The decay time, CIE coordinates and CCT values were also investigated. The CIE coordinates of the glass samples in this work located in weight light region.

Keywords: Oxyfluride phosphate glass, Photoluminescence, JO theory

Effects of BaO and Bi_2O_3 on the optical and luminescence properties of Dy^{3+} doped borophosphate glasses

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Abstract

Barium borophosphate glass and bismuth borophosphate glass doped with 1 mol% dysprosium oxide were synthesized by melt-quenching technique at 1200 ºC. Both glasses were studied optical and luminescence properties to evaluate their potential to using as luminescence materials. The absorption spectra in the region of ultraviolet, visible and near-infrared from 300 to 2000 nm were investigated. The luminescence spectra showed the strong emission band at 573 nm ($^4F_{9/2} \rightarrow {}^6H_{13/2}$) under 350 nm excitation wavelength, which the shapes of the emission bands are similar in both glasses. The optical absorption and luminescence intensity of barium borophosphate glass are higher than bismuth borophosphate glass. Also, it is observed that the direct and indirect bandgap values of barium borophosphate glass are found larger than bismuth borophosphate glass.

Keywords: Borophosphate glasses, Dysprosium, Luminescence, Optical band gap

DO0071

Optical and physical investigations of CuO dope in glasses prepared from rice husk ash

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Abstract

In this work, physical properties of glass form rice husk ash (RHA). Compositions of RHA were analyzed by X-Ray fluorescence Spectrometer (XRF). The glasses were melted from rice husk ash as a SiO_2 in formula $(40-x)SiO_2$: $10B_2O_3$: $25Na_2O$: 8CaO: 5ZrO: $1Bi_2O_3$: $0.5TiO_2$: $0.5Al_2O_3$: 10BaO: xCuO, where x is concentration of CuO. The density and refractive index of glasses were increased when increasing concentrations of CuO. Absorption spectra were measured by UV-visible spectrometer, the absorption peak was found at 784 nm ($^2B_{1g} \rightarrow {}^2B_{2g}$) is due to Cu^{2+} ion in octahedral coordination with a strong tetragonal distortion. The color coordinate in CIE L*a*b* system of glasses were measured and show good correspond with absorption spectra.

Keywords : Rice husk ash , XRF , UV-visible spectrometer, physical properties, CuO

DO0072

Enhancement of emission intensity in Dy^{3+}-doped ZnO/ZnF_2 phosphoborate glasses for W-LED materials

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Abstract

Presently, white light emitting diodes (W-LEDs) were be used to substitute for conventional incandescent and fluorescent lamps due to their advantages; thus, it gets attention to create Dy^{3+}-doped zinc phosphoborate glasses for enhancing better lightness. In this research, the replacing of ZnO by ZnF_2 in $49B_2O_3$:$30P_2O_5$:$(20-x)$ZnO:xZnF_2:$1Dy_2O_3$ glasses, $0 \leq x \leq 20$ mol% were prepared by melt quenching method and investigated through optical absorption and photoluminescence properties. The absorption results can be used for calculating the Judd-Ofelt (JO) intensity parameters (Ω_λ, $\lambda = 2$, 4 and 6) and led to predicting the stimulated emission in present glasses. The trend of JO parameters is found to be $\Omega_2 > \Omega_4 > \Omega_6$ for all glasses. Nevertheless, replacing of ZnF_2 does not affect position and intensity of optical absorption of Dy^{3+}-doped glasses, whereas the observed blue (481 nm), yellow (572 nm) and red (662 and 751 nm) emission intensities of photoluminescence spectra rise with ZnF_2 contents; the emission intensity at 572 nm for 20ZnF_2 show the highest and was higher than 20ZnO around 1.6 times. The emission color of Dy^{3+}-doped zinc phosphoborate glasses has been evaluated with CIE 1931 chromaticity diagram. The results revealed that all glasses emit white light. Hence, these glasses may be suitable candidate for using in W-LED and lightening materials.

Keywords: Phosphoborate glass, photoluminescence; W-LEDs; ZnF_2

DO0074

Fabrication of $Ca_{12}Al_{14}O_{33}$ mayenite structure by spark plasma sintering

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Abstract

In this work, the $Ca_{12}Al_{14}O_{33}$ (C12A7) compounds were consolidated by spark plasma sintering (SPS) at 1100, 1200, 1300 and 1350 °C for 5 min, 50 MPa. The XRD result indicated the C12A7 phase in all specimens. The SPS method possesses a fast heating rate with an applied pressure which could result in a high density product. The relative density increased from 87.1 to 99.4% with increasing sintering temperature. The diffusion of carbon from graphite mold might induce the reduction atmosphere surrounding specimen. This could be the key factor to improve the electrical properties of C12A7. The electrical conductivity was enhanced by increasing sintering temperature. The C12A7 specimens sintered at 1350 °C showed the highest electrical conductivity of 1.96 S m^{-1} at 800 °C.

Keywords: C12A7, mayenite, spark plasma sintering

DO0111

Effects of Mn doping on structure and electrochemical properties of $BiVO_4$ nanoparticles

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Abstract

In this work, the $BiV_{1-x}Mn_xO_4$ (x = 0, 0.05, 0.1 and 0.2) nanoparticles were successfully prepared by a simple solution method. The prepared nanoparticles were characterized by X-ray diffraction (XRD) analysis, Brunauer-Emmett-teller (BET) method and X-ray absorption spectroscopy (XAS) technique. Additionally, the prepared samples were fabricated as electrodes to study the electrochemical properties by Cyclic voltammetry (CV), Galvanostatic charge-discharge (GCD) and Electrochemical impedance spectroscopy (EIS) method. The Mn doping can increase of the crystallize size, specific surface area and total pore volume, which caused improving of specific capacitance of the electrodes. The $BiV_{0.8}Mn_{0.2}O_4$ electrode exhibits the highest specific capacitance of 226 F g^{-1} at 2 A g^{-1}.

Keywords: $BiV_{1-x}Mn_xO_4$ (x = 0, 0.05, 0.1 and 0.2) nanoparticles, electrochemical properties, specific capacitance

DO0114

Poster Presentration

Effect of milling techniques on the particle characteristics of conductive Pr-substituted YBa_2CuO_{7-y} compound

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Abstract

In this work, the effects of milling techniques on Pr-substituted $YBa_2Cu_3O_{7-y}$ particles were investigated. The Pr-substituted $YBa_2Cu_3O_{7-y}$ powders were prepared by solid-state reaction method. The stoichiometric mixtures of Y_2O_3, $BaCO_3$, CuO and Pr_6O_{11} starting powders were calcined at 880 ^oC for 12 h in air to form respective compounds. The resulting products were milled for 4 – 12 h using the conventional ball milling technique. The high-energy planetary ball milling and manual grinding methods were also carried out at various time period. The phase and structure identification of powders were characterized by X-ray diffraction technique (XRD). The microstructure and chemical composition were studied using scanning electron microscopy (SEM) with energy dispersive X-ray analysis (EDS). The size distribution of samples was examined by a particle size analyzer and their specific surface area (SA) was also determined. The data of the powders prepared by different milling methods were compared and discussed in detail in terms of particle characteristics and their potential use in colloidal solution for printed thermoelectric film.

Keywords: YBCO, PrBCO, milling technique, particles size, nanoparticles

Enhancing thermoelectric properties of p-type SiGe alloy through optimization of carrier concentration and processing parameters

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Abstract

The enhancement in thermoelectric (TE) properties of *p*-type SiGe alloys through the optimization of carrier concentration and processing parameters was reported. The *p*-type $Si_{80}Ge_{20}B_x$ alloys were prepared by melt spinning (MS) followed by spark plasma sintering (SPS). The effect of B concentration and processing parameters (rotating speed of Cu wheel in MS and holding time in SPS) was investigated. By adjusting the B content, the carrier concentration was notably changed but the carrier mobility was not significantly different. Consequently, TE properties were varied with B concentration and showed the optimum value for $Si_{80}Ge_{20}B_{0.5}$ with the maximum *ZT* of 0.71 at 1073 K. Increasing the Cu wheel rotating speed resulted in the refined microstructure of the MS ribbons. The smaller grain sizes were maintained even after SPS. However, despite the refined grains, the TE properties were insignificantly different for any rotating speed. Reducing the SPS holding time resulted in bulk samples with lower density, presumably containing nano/micro porous structure. The presence of pores in the microstructure effectively reduced thermal conductivity due to a stronger phonon scattering, but also suppressed the electrical contribution making an obvious drop in the power factor. The optimized holding time for SPS was 5 minutes at 1323 K.

Keywords: *Thermoelectric; SiGe; p-type; boron concentration; melt spinning; spark plasma sintering*

AP0010

Thermoelectric performance evaluation of $FevSb_{1-x}Se_x$ half-heusler compounds synthesized via mechanical alloying and vacuum hot pressing

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Abstract

Among the thermoelectric materials, doped and intrinsic FeVSb half-Heusler alloys showed some sort of improvement in the field of thermoelectric efficiency. Various compositions of $FeVSb_{1-x}Se_x$ ($0.03<x<0.15$) half-Heusler alloys were synthesized via mechanical alloying and vacuum hot pressing. Phase transition was analyzed during the milling process and after vacuum hot pressing. It showed nearly single half-Heusler phases with a small fraction of second phases in vacuum hot pressing samples. Se doping drove the material system to n-type conduction. This is because Se generally acts as a donor atom. Consequently, negative value of Seebeck coefficient is observed. The Seebeck coefficient increased with increasing doping concentration up to the optimum temperature. It could be possibly due to decreasing carrier concentration, considerably higher Hall mobility and enhanced effective mass of the carriers. Thermal conductivity was found to be decreased significantly. It might be due to second phase interaction and grain boundary scattering. The resultant maximum dimensionless figure of merit was compared with the analogous material systems.

Keyword: Doping, mechanical alloying, seebeck coefficient, thermal conductivity, carrier concentration

Synthesis and thermoelectric properties of Ag-Sb-Te thin films

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Abstract

The Ag-Sb-Te thin films on glass substrate were successfully deposited by DC magnetron sputtering method and annealed the thin films at the temperature range 573 to 773 K under Ar atmosphere for 30 min. The morphology, phase structures, electrical conductivity and Seebeck coefficient of thin films were investigated by Scanning electron microscope, X-ray diffraction and ZEM3, respectively. We found that the surface was agglomerated and including behavior liquid after increasing annealing temperature. Phase structure was mixed phase which found cubic structure to diffraction reflections of (200) and (222) planes and rhombohedral structure according to (0111) and (110) planes. The Ag-Sb-Te thin films had electrical conductivity of 0.94×10^4 S m^{-1}, Seebeck coefficient of 179 μV K^{-1} and power factor of 3.05 mW m^{-1} K^{-2} annealed at 573 K.

Keywords: Ag-Sb-Te thin films, thermoelectric properties, annealing temperature, sputtering

AP0020

Enhancing thermoelectric properties of p-type SiGe alloy through optimization of carrier concentration and processing parameters

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Abstract

The enhancement in thermoelectric (TE) properties of *p*-type SiGe alloys through the optimization of carrier concentration and processing parameters was reported. The *p*-type $Si_{80}Ge_{20}B_x$ alloys were prepared by melt spinning (MS) followed by spark plasma sintering (SPS). The effect of B concentration and processing parameters (rotating speed of Cu wheel in MS and holding time in SPS) was investigated. By adjusting the B content, the carrier concentration was notably changed but the carrier mobility was not significantly different. Consequently, TE properties were varied with B concentration and showed the optimum value for $Si_{80}Ge_{20}B_{0.5}$ with the maximum *ZT* of 0.71 at 1073 K. Increasing the Cu wheel rotating speed resulted in the refined microstructure of the MS ribbons. The smaller grain sizes were maintained even after SPS. However, despite the refined grains, the TE properties were insignificantly different for any rotating speed. Reducing the SPS holding time resulted in bulk samples with lower density, presumably containing nano/micro porous structure. The presence of pores in the microstructure effectively reduced thermal conductivity due to a stronger phonon scattering, but also suppressed the electrical contribution making an obvious drop in the power factor. The optimized holding time for SPS was 5 min at 1323 K.

Keywords: *Thermoelectric; SiGe; p-type; boron concentration; melt spinning; spark plasma sintering*

AP0010

Synthesized transparent thermoelectric p-type γ–CuI thin film using liquid iodination method

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Abstract

Developments in thermoelectric (TE) transparent p-type materials are scarce and do not follow the trend of the corresponding n-type materials – a limitation of the current transparent thermoelectric devices. This work, γ–CuI thin films have been synthesized by the iodination of Cu thin layers with dip iodine solution. Cu thin layer were deposited on a glass substrate using an DC magnetron sputtering technique. The O_2 flow rate during the deposition process were 2, 4, 6, 8 and 10 sccm. The X-ray diffraction results showed highly γ–CuI structure. The microstructure, chemical state, optical and thermoelectric properties will be investigated.

Keywords: CuI thin films, p-type transparent conductor, transparent thermoelectric

AP0040

Enhancing structural, electrical and thermoelectric properties of p-type antimony telluride flexible films using thermal treatment via rapid microwave-assisted DC magnetron sputtering technique

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Abstract

P-type antimony telluride (Sb_2Te_3) flexible films were deposited on polyimide substrate (0.025 mm) using an alloy Sb_2Te_3 target via rapid microwave-assisted DC magnetron sputtering technique. The influence of thermal treatment with various temperature 100-400ºC in N_2 atmosphere for 1 min on their structural, stoichiometry, surface morphology, electrical and thermoelectric properties were investigated. The crystallinity of the Sb_2Te_3 films is heightened by thermal treatment process. The crystalline structure and chemical composition of the films were characterized by X-ray diffraction and energy-dispersive X-ray spectroscopy, respectively. Scanning electron microscope was taken to observe the surface morphologies. The electrical transport propertied of the films including carrier concentration, carrier mobility and electrical resistivity were examined by hall-effect measurement at room temperature. The temperature-dependent Seebeck coefficient were simultaneously observed by ZEM-3. Thermal treatment of p-type Sb_2Te_3 flexible films were used to improve the crystallinity and electrical conductivity, leading to the highest value of the power factor.

Keywords: antimony telluride; flexible substrate; rapid microwave-assisted DC magnetron sputtering

AP0048

Thermoelectric properties of bulk p-type Cu_2ZnSnS_4 materials prepared by hot pressing method

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Abstract

Bulk Cu_2ZnSnS_4 (CZTS) p-type thermoelectric material were synthesized by sol-gel processe from precusor cupric chloride, zinc chloride, tin dichloride and thiourea mixed in deionized water stirrer for 2 h at temperature 120 °C, annealed in argon flow at 500 °C for 30 min. Bulk samples were prepared by hot-pressing method at 800 °C for 2 h. The thermoelectric properties of bulk CZTS material were characterized the electrical resistivity, seebeck coefficient, resistivity and thermal conductivity. The results of this work are very promising to development the p-type semiconductor material of thermoelectric module in the future.

Keywords: CZTS, semiconductor, thermoelectric, p-type, thermoelectric bulk

AP0062

Thermoelectric properties of n-doped $Ge_2Sb_2Te_5$ thin film

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Abstract

We present the thermoelectric properties of N-doped $Ge_2Sb_2Te_5$ (GST) thin film as prepared by pulsed-dc magnetron sputtering method. As-deposited GST thin films were annealed at temperature range 250 ºC to 400 ºC within the N_2 atmosphere to be obtained N-doped GST for investigating on microstructure and thermoelectric properties. The results demonstrated that the as-deposited GST thin film sample was amorphous generally and then became crystalline after the annealing process. At temperature annealed 300 to 400 ºC, the XRD had the Ge_3N_4 peaks mixing. Effect of the Ge_3N_4 formation has been enhanced the power factor of GST thin film about 1 order of magnitude (4.31×10^{-5} $Wm^{-1}K^{-2}$ for GST and 6.75×10^{-4} $Wm^{-1}K^{-2}$ for N-doped GST) at room temperature.

Keywords: Thermoelectric thin film, N-doped $Ge_2Sb_2Te_5$, pulsed-dc magnetron sputtering

Thermoelectric properties of Mg-doped $CuCrO_2$ materials

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Abstract

Recently, thermoelectric devices based on Mg-doped $CuCrO_2$ delafossite-type oxide have emerged as a promising solution to transfer the waste heat into electricity. In this report, we systematically investigate the structural, electrical, morphological, optical and thermoelectric properties of Mg-doped $CuCrO_2$ materials with 5% at Mg dopant ($CuCr_{0.95}Mg_{0.05}O_2$). The $CuCr_{0.95}Mg_{0.05}O_2$ sample was fabricated using solid-state reaction method at 1673 K. From a detailed analysis of X-ray diffraction, we realize that $CuCr_{0.95}Mg_{0.05}O_2$ sample completely crystallizes in form of delafossite structure. As can be seen from FESEM images, the rhombohedral structure (*R-3m*) of $CuCr_{0.95}Mg_{0.05}O_2$ crystal reveals the fine grain size. FTIR and Raman spectra also contribute to proving the existence of delafossite structure in our sample. From Hall measurement results, the hole concentration, mobility and resistivity obtain the value of 9×10^{17} cm^{-3}, 2 $cm^2.V^{-1}\cdot s^{-1}$ and 3 Ω.cm, respectively. Besides, our sample obtains the Seebeck value of 446 μV K^{-1} at room temperature.

Keywords: Thermoelectric material, p-type delafossite, $CuCrO_2$

AP0086

Preparation for the nano crystalline size of thermoelectric CCO-349 by planetary ball mill/quickly hot-press method

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Abstract

The nanocrystalline size of calcium cobalt oxide (CCO-349) powder was prepared from mixing nanopowder (50 nm) of $CaCO_3$ and Co_2O_3 by planetary ball mill (PBM) method. The samples of CCO-340 were encased in zirconia balls, then milled at a rotating velocity of 350 rpm for 0.5 to 8.0 h at room temperature. The mixed nanopowders were analyzed crystal structure by X-ray diffraction (XRD) technique, the phase equilibria studies by phase diagram of pure component and compared with the Thermogravimetry (TG) and Differential Thermal Analyzer (DTA) results. We can decrease the mixed powders size as much as possible to 10 nm approximately confirmed by Scanning Electron Microscopy (SEM) and found that the phase diagrams at lower and higher temperatures of CCO systems for calcination and sintering process. The mixed excellent powder (9 nm) was calcined by the furnace at 1173 K in air for 10 h which using data from phase diagrams and TG-DTA results and then reduced powder size again by PBM method for 2 h to 15.53nm and sintered by quickly hot press at 1173 K in Argon atmosphere for 0.5 h. The calcined powder shows monoclinic structure a = 4.8404 Å, b = 4.4884 Å, c = 10.7717 Å, β = 98.67107 Å. The sintered powder and bulk showed monoclinic structure a = 4.8227 Å, b = 4.2326 Å, c = 10.6586 Å, β = 97.94837 Å and crystallite size of 13.88 nm correspond with images for SEM. The crystalline size was decreased from 50 nm to ∼9 nm with ball milling 10 h.

Keywords: nanocrystalline, CCO-349, particle size, planetary ball milling process

AP0090

Controlling structural and thermoelectric properties of Ga and In dually-doped ZnO ceramics via tuning powder particle size and phase segregation

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Abstract

Thermoelectrics is well-known as a green-energy technology that converts directly waste heat to electricity. In this work, zinc oxide (ZnO), a potential thermoelectric material, was chosen to study due to its abundance, non-toxicity and thermal stability. The Ga and In dually-doped ZnO (IGZO) ceramics exhibited the enhancement of thermoelectric properties which was mainly attributed to lower thermal conductivity than 5 W $m^{-1} \cdot K^{-1}$. The systematic comparison between IGZO ceramics fabricated by two different high-temperature sintering processes was carried out. As a result, precursor-powder particle size and phase segregation were demonstrated to control the structural and thermoelectric properties, especially thermal conductivity. The characteristics of phase segregation was clearly shown in the X-ray diffraction (XRD) patterns, which mechanism was explained by the X-ray photoelectron spectra (XPS). It was a factor which influenced directly to carrier concentration-dependent electrical conductivity and power factor. On the other hand, the difference of powder particle size leading to the change in crystalline morphology could be observed through the scanning electron microscopic (SEM) micrographs. It was responsibility for the evolution of thermal conductivity. In addition, the correlation between powder particle size, phase segregation and sintering processes was also discussed.

Keywords: Thermoelectrics, dually-doped ZnO ceramics, powder particle size, phase segregation

Modeling and experimental study of $CaMnO_2$ TEG module

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Abstract

A modeling and experimental study of $CaMnO_2$ thermoelectric generator (TEG) modules are investigated. Efficiencies of n-type $CaMnO_2$ TEG modules are theoretically predicted using the modeling software COMSOL Multiphysics. Among temperature gradients from 0 to 500 degree Celsius, the performance of 1 module, 2 modules in series and 56 modules in series are compared with the experimental results and there are a good agreement between them.

Keywords: $CaMnO_2$, TEG module

AP0102

Electrical Energy Harvesting from Human Heat using Flexible Thermoelectric Devices

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Abstract

Flexible thermoelectric devices (FTD) used for converting human body heat energy to electrical energy. The proposed FTD was composed of a polydimethylsiloxane (PDMS) substrate and n-Bi_2Te_3 and p-Sb_2Te_3 thermoelements, Cu and Ag electrodes. The use of PDMS provides flexibility to the FTD and low thermal conductivity that helps minimize losses in the effective heat flowing through the good thermoelements. The proposed FTD was fabricated by DC magnetron sputtering method for thermoelectric and electrode materials and annealed at low temperature. The fabricated FTD was attached to the human body and generated electrical power of 0.073 μW at different temperature between the human body and ambient air was 5 °C

Keywords: thermoelectric devices, thermoelectric sensor, thin film thermoelectric, microgenerator

BP0002

Oxide thermoelectric module application with the stove

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Abstract

Currently, the demand for electricity is increasing. It is necessary to increase the electricity supply to meet the demand. Alternative energy has been found to meet the demand. This research project has the objective for synthesis thermoelectric materials Ag-Mn doped p-$Ca_3Co_4O_9$ and Al doped n-ZnO, development of thermoelectric module from materials synthesized and development of thermoelectric generator application with the stove. In the methodology, started from synthesis thermoelectric materials by ball mill and solid state reaction method, fabrication thermoelectric module by silver paint connection. Crystal structure was analyzed by X-ray diffraction technique. Thermoelectric properties were measured by Seebeck coefficient and electrical resistance measuring system (ZEM-3). It was found that, the p - $Ca_{2.8}Ag_{0.2}Co_{3.8}Mn_{0.2}O_9$ shows mix phase between tetragonal and Rhombohedral. The Seebeck coefficient, electrical resistivity and power factor show 206 μV K^{-1}, 1.05 mΩ m and 34.20 μ W m^{-1} K^{-2} at 860 K, respectively. The n - $ZnAl_{0.02}O_9$ shows single phase of Cubic structure. The Seebeck coefficient, electrical resistivity and power factor show –225 μV K^{-1} 1.29 mΩ m and 39.1 μ W m^{-1} K^{-2} at 956 K, respectively. The maximum value of open circuit voltage is shows 0.4 V at different temperature 100 K. The electrical power was measured by various load resistance and shows the maximum power at load resistance 100 kΩ about 0.44 μW. The relationship between electrical power and different temperature by using load resistance 100 kΩ was measured 5 times and found that, the 1st time show maximum value about 1.481 μW and decreasing at 2nd, 3rd, 4th and 5th, respectively. The application of thermoelectric module with the stove is shows the maximum electrical voltage value about 0.4 V and electrical power about 0.5 μW at 16 min and different temperature between stove wall and heatsink at 125 K. The electrical voltage and power are stable at 60 minutes about 0.26 V and 0.2 μW, respectively which is low value. It is necessary to increase the number of thermoelectric modules because the furnace wall has a lot of space to be able to apply electricity to electrical equipment

Keywords: Heat generator, oxide thermoelectric, stove

BP0004

Fabrication of thermoelectric modules by high pressure continuous automatic machine

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Abstract

This work proposed the in-house thermoelectric modules fabrication machine. A continuous high pressure autoclave extrusion machine as the fabrication machine was completely constructed. The machine was consisted of 3 components: (1) transmission cylinder (3) unit power hydraulic pressure and (3) automatic control system. The thermoelectric modules with density were produced by automatic extrusion process in increasing of number thermoelectric modules by delivering more volume in less time. The $CaMnO_3$ compound was selected for stating thermoelectric materials in fabrication testing. The $CaMnO_3$ was prepare by Solid state reaction method (SSR). The $CaMnO_3$ powder was confirmed identity by X-ray diffraction (XRD). The modules were extruded in a diameter 10 mm, high 20 mm by 3000 kPa pressure at room temperature. The experimental result found that the fabrication of cylindrical $CaMnO_3$ thermoelectric modules can be produced in 3 modules at the same time. The daily an average capacity can be fabricated in 400 modules per day. In testing of electrical values, the maximum electric potential is in 155Mv and electric current is in 1.1 mA in temperature difference of 470 °C for the high temperature side module at 650 °C. Also, the high pressure continuous automatic machine is suitable for thermoelectric module to fabricate thermoelectric devices in application of electricity generator from the various heat sources.

Keyword: $CaMnO_3$, Thermoelectric modules, Density, High pressure.

BP0094

Thin films thermoelectric generator of p-AST/n-BT

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Abstract

This project research developed the thin film thermoelectric generator by using multi-magnetron sputtering at in-house-built. The thin film thermoelectric was synthesized from Silver-Antimony-Telluride (Ag-Sb-Te; AST) and Bismuth-Telluride (Bi-Te; BT) as connected by Ag thin film electrode. The fabrication of thin film thermoelectric module used p-AST and n-BT thin films as followed best condition of each material for 3 modules then connect together with a series to be developed a thin film thermoelectric generation. It was fond that, a thin film thermoelectric generator had open circuit Voltage, internal resistance and maximum power approximately 223 mV, 7.67 kΩ and 1.6 μW at differential temperature of 30 ºC, respectively

Keywords: Multi-magnetron sputtering system, thin films thermoelectric generator, silver-antimony-telluride (Ag-Sb-Te), bismuth-telluride (Bi- Te)

BP0100

The low-cost and accuracy instrument for measuring spin seebeck effect

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Abstract

The generation of pure spin current by temperature is known as the spin Seebeck effect (SSE). The instrument for measuring the spin Seebeck coefficient was carried out in building the uniformity of magnetic field and temperature difference. To magnetize a magnetic materials, the 2 Neodymium permanent-magnets (NdPM) in a cylinder shape of 100 mm diameter and 50 mm length were placed parallel to each other. The non magnet materials of vacuum chamber were inserted between gaps of NdPM. To generate temperature difference, the passive heater was inserted on hot-side of copper block and then it is held on cool side of copper block by using a plastic nut. To find the SSE characteristics, we measure the transverse voltage from the Platinum (5 nm)/Yttrium-Iron-Garnet (YIG) magnetic junctions as the calibrator for magnetic field dependence, temperature dependence and magnetic field angle dependence, respectively. The experiment results found that the uniformity of magnetic field is 0.75±0.05 Tesla (T) in the gap of 16 mm length which is enough to magnetize a soft magnetic material for small sample of 10 mm size. The temperature difference is varying in range of 0 K to 50 K which the cold side is dipped in a room temperature (300 K). The uniformity of a temperature difference is tended to stability about 3 minutes after heating a copper block which the deviation value is observed in range of ± 0.1 K under the pressure of 50 Torr. Furthermore, the SSE characteristics of magnetic field dependence are observed the voltage symmetry at ±0.75 T and disappear at 0 T. The temperature dependence is found that the SSE voltage is linear increase with increasing the temperature difference and then it is switching the voltage symmetry with applied anti-magnetic field direction. The lastly, the magnetic field angle dependence is detected in the sinusoidal waveform which is confirmed behavior of the SSE characteristic. In conclusion, our instrument for observation the SSE is accurate detection including of magnetic field dependence, temperature dependence and magnetic field angle dependence, respectively.

Keywords: Spin Seebeck effect, pure spin current, nersnt effect, spintronic, inverse spin hall effect

Application of thermoelectric generator in incinerator

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Abstract

The thermoelectric generator (TEG) with a directly conversion of waste-heat into electricity is an alternative green energy. The main problem of TEG is a cooling system for it cool side. In this work, we studied the efficiency of TEG combined with household waste incinerator. The 200 liter of incinerator was fabricated with 24 of TEG by series. The sterling engine was employed to fabric a cooling system. In an experiment, the household waste incinerator was performed for 30 minutes. Also, the voltage-output (V_{out}) was measured and averaged for ten times. We found that, the maximum V_{out} with value of 20.71 V has obtained at temperature difference equal 67.70 °C. The calculated of efficiency showed the efficiency of 23.94% for heat-sink cooling system has enhanced to 47.30% for sterling engine cooling.

Keywords: Thermoelectric generator, sterling engine, incinerator

CP0024

Hybrid microwave solid-state synthesis method for rapid synthesis of SnTe for the thermoelectric material

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Abstract

Tin telluride (SnTe) has been investigated intensively for thermoelectric (TE) materials in addressing the energy crisis worldwide, due to its high performance in a wide range temperature. In this work, we successfully synthesized SnTe powders by a simple, rapid and high-yield method called hybrid microwave solid-state synthesis for the first time and also measured their thermoelectric properties. By rationally controlling the hybrid microwave temperature, we found that at 500 ℃ for 1 min reacted sample exhibited the most outstanding specific electrical transport properties. The hybrid microwave solid-state synthesis method is efficient and rapid for preparing SnTe thermoelectric materials.

Keyword : Hybrid microwave solid-state synthesis method, tin telluride(SnTe), thermoelectric

Fabrication of new thermoelectric block floor for power generator

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Abstract

This was the study and designing of the thermoelectric block floor for power generator that are normally used for footpaths, traffic islands and gardening together with solar radiation heat. Physically, this thermoelectric block is an octagonal block with a size of 19.8 × 19.8 × 6 cm^{-3}. The block was composed of two layers. The upper layer received the solar radiation and produced the thermoelectric module heat by synthesizing thermoelectric materials and creating 4 thermoelectric modules from Bi_2Te_3 for one composition set where an aluminum sheet was used for cooling. Additionally, the lower layer was exposed to the ground with low temperature to produce the usable electric power. The efficiency of this electric power was tested with the solar radiation heat of the thermoelectric block floor and by the Thai Industrial Standards (TIS) 827-2531: Interlocking Concrete Paving Blocks. After installing the thermoelectric block floor at the Faculty of Industrial Technology, Sakon Nakhon Rajabhat University, it was found that the block was usable as defined by TIS 827-2531: Interlocking Concrete Paving Blocks; meanwhile, the test on the electric power of the thermoelectric block floor indicated that the maximum electric potential difference was 73.91 mV where the temperature difference was 6.2 °C measured from the surface of the block. In addition, the maximum electric power was 88.25 mV where the solar radiation was 1124.5 $W \cdot m^{-2}$. Notably, this electric power of the thermoelectric block floor was directly variable following the solar radiation value. However, if used for power generator or as an alternative energy for engineering activities, the thermoelectric block should be properly designed and developed to produce higher level of electric power and more of them should be created for both series circuit and parallel circuit.

Keywords: block floor, thermoelectric, power generator, thermoelectric block floor

CP0058

Prototype of concrete block electric power generation from heat and applications in municipal melting furnace or municipal incinerator

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Abstract

We investigated the concrete block electric power generation from heat and applications in municipal melting furnace or municipal incinerator (CGH) prototype working at high temperature up to 800 ^{o}C. The CGH prototype was used the Seebeck effect schematic by directly convert heat into electricity. The CGH prototype was consisted of thermoelectric modules having thermoelectric material synthesized from $CaMnO_3$ thermoelectric material in our laboratory. A single thermoelectric module showed voltage 155 mV, current 11 mA, and the electrical power 1.7 mW in temperature difference of 470 ^{o}C for the high temperature side module at 650 ^{o}C. The electrical power can be increased with connecting by several thermoelectric modules together. The experimental results indicated that the electrical power is directly proportional to the number of thermoelectric modules. We also show that the CGH prototype consisting of 56 thermoelectric modules connected into series could immediately light up the 150 mW LED in temperature difference of 465 °C for the high temperature side module at 650 ^{o}C. The CGH prototype can apply in thermal energy from various heat sources such as burning biomass and waste, heat industrial and power plants. Our CGH prototype may be scaled into large-scale thermal power plant to supply the electrical energy to our industry.

Keyword: $CaMnO_3$, thermoelectric, generator, concrete blocks

Design and controller of thermoelectric cooler for turbo molecular pump cooling applications

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Abstract

The cooling of bearings/drive-motor of turbo molecular pump (TMP) request less than 120 °C due to the heat may be prone to depositing reaction products. Example, TMP of ULVAC products used water cooling for control heat generated in the bearings and the drive motor. In this work, we designed and analyzed to be made the controller of thermoelectric cooler (TEC) for using in turbo molecular pump cooling without the water cooling. The TEC for TMP cooling was designed and analyzed by Finite element method to be studied the heat generate and transfer the waste heat to another section of the apparatus releases. The controller has applied the control though Arduino board into a transformer and drive dc current for TEC of 6 modules. The result shows the TEC could be controlled for TMP cooling in the temperature range 15–25 °C and the waste heat released environment less than 40 °C approximately.

Keywords: Thermoelectric cooler, turbo molecular pump, bearings, drive-motor

Thermoelectric application with solution sensor

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Abstract

This research has the objective for synthesis thermoelectric materials of p-$Ca_3Co_4O_9$, n-ZnO by steady state reaction method, thermoelectric properties are measured. Thermoelectric cell was fabricated from synthesis materials. Thermoelectric sensor was fabricated by thermoelectric materials, arduino program for measurement and analysis data and display results by LCD. It was found that, the Seebeck coefficient, electrical resistivity, thermal conductivity and dimensionless figure of merit of p-$Ca_3Co_4O_9$ are 239.77 μV K^{-1} 11.4 mΩ cm 2.84 W m^{-1} K^{-1} and 0.01 and n-ZnO are -0.474 mV K^{-1} 5.71 m 18.86 W m^{-1} K^{-1} and 0.59×10^{-6}, respectively at 473 K. The thermoelectric cell can generate open circuit voltage and power output 112.8 mV and 0.67 μW, respectively at differential temperature 180 K. The resultant of thermoelectric sensor shows maximum voltage the salt solution of 27.12 mV at 38 s, the sugar solution 25.62 mV at 20 s and water 24.62 mV at 26 s

Keywords: Sensor, thermoelectric, p-$Ca_3Co_4O_9$ and n-ZnO

CP0109

Producing electric from heat to renewable energy natural Energy creation House

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Abstract

Natural Energy Creation House (NECH) used for converting thermal energy from the sun to electrical energy. The proposed NECH was composed of using science and electronics knowledge to apply in daily life. Using the method of producing electric from heat to renewable energy in order to reach the most advantageous and worthiest. The thermal from the sun was impacted to the Aluzinc metal sheets to lead the heat gather to thermoelectric sheets. The lower part of thermoelectric sheets was received cool from cooling water block and heat sink panel caused the difference of temperature in thermoelectric sheets until it occurred the electricity accumulating in battery using as the electric energy source for small electronic devices such as portable phones, communication devices, and radio or a good small battery charging. In addition, the advantage from the heat of thermoelectric sheets was transfused to cooling water block caused the inside water warmer till take it out. Warming water was flowed pass the water block that occurred from the water pressure and cool water was keeping on replaced in the blocks which could be apply immediately or get more warmer to use in water heater, vacuum water or wash containers later.

Key word; thermoelectric devices, Aluzinc metal sheet

CP0118

Comparison study of clear glazes at different temperatures from glass beer bottles waste used as glaze decoration on ceramic products

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Abstract

The recycled glass bottles used to study glaze decoration on ceramic body. The glass bottle is the most common type used for consumer containers. They are colorless green glass. The study in comparison of clear glazes at different temperatures from a glass beer bottle in oxidation atmosphere, the objectives of this study were 1) comparison of the physical properties of clear glazes after the burn 1100, 1165, and 1200 °C in oxidation atmosphere, 2) study the optimum temperature of clear glazes from a glass beer bottle in oxidation atmosphere and 3) reuse glass beer bottle used or damaged, use of ceramics glazes. Products is dipping with glazes water is crushed glass from glass beer bottle : glazes : Copper oxide percentage 8 : 92 : 0.70 respectively, then bring it burned at different temperatures in oxidation atmosphere. Data was analyzed using analyze physical properties. It was found that all burn temperatures have the optimum physical properties for the clear glazes. Is after burn at 1100 °C to be Pine Green color and after burn at 1165 and 1200 °C to be Emerald color, luster and fusion occurs has in all temperatures and all products, running and crazing of the clear glazes hasn't. But after burn at 1100 °C products is Pinholes, after burn at 1165 and 1200 °C it is similar physical properties. In consequence of burn at 1165 °C is optimum temperature of clear glazes, because products is not Pinhole and save energy in burning glazes.

KeyWord: Ceramic glaze, atmosphere, burning glazes, beer bottle

DP0003

Electrical and sensitivity properties of ZnO/TiO_2 heterojunction nanocomposites for ammonia gas sensor

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Abstract

ZnO/TiO_2 heterojunction nanocomposites were synthesized via a thermal process. The surface morphology and crystal structures of the fabricated samples were characterized by scanning electron microscopy (SEM) and X-ray diffractometer (XRD) techniques, respectively. The synthesized TiO_2 nanoparticles have a diameter of 50 – 100 nm. The current – voltage response of the heterojunction nanocomposites obeys ohmic contact materials. The sensitivity of the fabricated samples was measured under ammonia atmosphere for 200 seconds at room temperatures. The maximum response of ZnO/TiO_2 nanoparticles is 27.30 for 200 seconds. These heterojunction nanocomposites are potentially applied for ammonia gas detection.

Keywords: ZnO/TiO_2 nanocomposites, ZnO/TiO_2 heterojunction, ammonia gas sensor

DP0006

Highly ordered titania nanotube arrays synthesized via one-faced and single-step anodization

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Abstract

Highly ordered titania (TiO_2) nanotube arrays were synthesized via one-faced and single-step anodization method. Titanium foils were anodized in ethylene glycol (EG) based electrolytes containing 0.25 wt% NH_4F, 2 vol% H_2O and doped with various concentrations of $K_3[Fe(CN)_6]$ at applied voltage of 50 V for 2 h at room temperature. As-anodized samples were annealed at 450 °C for 2 h in order to transform the amorphous titania to nanocrytalline anatase. Highly ordered titania nanotube arrays were obtained after $K_3[Fe(CN)_6]$ at different concentrations was introduced. The surfaces of TiO_2 nanotubes were smoother after increasing concentrations of $K_3[Fe(CN)_6]$, confirmed by AFM investigation. Doping of $K_3[Fe(CN)_6]$ successfully extended the absorption spectrum of samples in range of 200 to 375 nm and lightly increased their band gap energy. Doping with 0.20 wt% $K_3[Fe(CN)_6]$ caused Ti 2p shift towards lower binding energy due to the reduction of Ti^{4+} to Ti^{3+}, thus improving the electrochemical performance of titania nanotubes. This work suggests an alternative method for fine tunning the size of TiO_2 nanotube arrays that widely applied in the field of energy conversion materials.

Keywords: Titania, anodization, nanotubes, $K_3[Fe(CN)_6]$, titanium dioxide

DP0007

Dielectric and ferroelectric properties of $(Pb_{1-x}La_x)(Zr_{0.53}Ti_{0.47})O_3$ ceramics

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Abstract

The $(Pb_{1-x}La_x)(Zr_{0.53}Ti_{0.47})O_3$ ceramics (PLZT) when x = 0, 4.5, 6.0 and 7.5 mol% were synthesized by powders of PbO_2, La_2O_3, ZrO_2 and TiO_2 by solid state reaction method. Then examine the crystalline structure of PLZT ceramics by X-ray diffraction, measuring density and Vickers Hardness, examine the dielectric and ferroelectric property of PLZT ceramics. The PLZT ceramics have crystal structure of Perovskite type tetragonal and hexagonal when x = 6.0 mol% lattice parameter a = b = 4.096 Å, c = 4.128 Å and c/a = 1.008. The density and Vickers Hardness trend is decrease when La increase. The dielectric constant of PLZT ceramics increased when the ratio of La in added where the ratio of La = 6.0 mol% the ε_r = 4619.30 at 412 ˚C. The Curie temperature of PLZT ceramics increase according the ratio of La addition. The dielectric and ferroelectric property of PLZT ceramics show behavior better when filled La into the position A site of Perovskite structure of PZT (53/47) ceramics.

Keywords: Dielectric; ferroelectric; PLZT ceramics; curie temperature

DP0011

Enhancements of growth and metabolites of *indica* rice callus (*Oryza sativa* L. cv. Pathumthani1) using TiO_2 nanoparticles (Nano-TiO_2)

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Abstract

In this research, the effects of a various in concentration of TiO_2 nanoparticles (Nano-TiO_2) were applied to study the cell growth, metabolites and antioxidant responses of callus in *indica* rice plants. Dose-dependent changes in growth performances, metabolite accumulations and antioxidant activities of callus were found. Mature seeds of *indica* rice cv. Pathumthani1 were cultured in callus induction medium with different concentrations of Nano-TiO_2 (0-600 mg L^{-1}). After five weeks of cultivation, the callus formations were measured in fresh weights and dry weights, and the contents of phenolic compounds, flavonoids and the antioxidant activities of callus extracts were assayed. The Nano-TiO_2 induced of fresh weights and dry weights in callus formations when compared with the control treatment (0 mg L^{-1} Nano-TiO_2) were also observed. The flavonoid and phenolic compound contents in rice callus exposed to 400 mg L^{-1} Nano-TiO_2 were 118% and 139%, respectively, higher than rice callus unexposed to Nano-TiO_2. Moreover, the antioxidant activities of the callus metabolites studied shows that the percentages of inhibition were up-regulated (84%) when exposed to 400 mg L^{-1} Nano-TiO_2, as a response to the high-level depletion of the free radicals in metabolites of rice callus. The results obtained from this research showed that the addition to Nano-TiO_2 had impacts on the callus growth and metabolite accumulations in rice callus. The results suggested that addition of Nano-TiO_2 at appropriate levels could role as an elicitor for biosynthesis of valuable metabolites and antioxidant properties for pharmaceutical applications in further research.

Keywords: Callus, Flavonoids, Nano-TiO_2, Phenolics, Rice

DP0012

Nanocarbon induced modifications in morpho-physiogical characteristics in rice plants [*Oryza sativa* L. cv. Black jasmine rice (Hom-nin)]

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Abstract

The aim of this research was to evaluate potential application of nanocarbon in plant growth and physiological responses for rice plants. This research was designed to evaluate the effects of different concentration of nanocarbon (0-1,000 mg L^{-1}) on growth characterizations and physiological parameters after 1-4 weeks nanocarbon-treatment. Induction in the growth performances and contents of photosynthetic pigments (chlorophyll A, chlorophyll B and carotenoids), antioxidant enzyme activities (catalase and peroxidase) and flavonoids was observed in the rice plants due to nanocarbon-treatment. The results showed that nanocarbon promoted the plant growth of rice plants cv. Black jasmine rice or Hom-nin, and significantly increased in shoot lengths and dry weights at 200 and 600 mg L^{-1}. Additionally, the high contents of photosynthetic pigment concentrations in treated-plants showed significant difference at 600 mg L^{-1} nanocarbon compared to the control (0 mg L^{-1} nanocarbon). The antioxidant activities of catalase and peroxidase enzymes in treated-plants were significantly increased with nanocarbon additions compared to the control. Furthermore, the induction of flavonoid contents in treated-plants was increased by 200 and 600 mg L^{-1} nanocarbon. The results suggested that nanocarbon increased biomass and was beneficial to increase the photosynthetic pigments and antioxidant enzymes for plant growth performances. This research provided plant growth and physiological responses evidence on the beneficial effect of nanocarbon in rice plants, especially Black jasmine rice or Hom-nin cultivar.

Keywords: Antioxidant enzymes, flavonoids, nanocarbon, photosynthetic pigments, plant growth, rice

DP0013

Structural, optical and electrical properties of $(CdS)_{1-x}(ZnTe)_x$ solid solution thin films prepared by vacuum thermal evaporation method

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Abstract

The II-VI compounds and their solid solutions are promising source for various types of thin film devices such as thin film transistors, optoelectronic devices and solar cells. The formation of $(CdS)_{1-x}(ZnTe)_x$ layer by interdiffusion of CdS and ZnTe during the fabrication of CdS/ZnTe heterojunction thin films was observed. The $(CdS)_{1-x}(ZnTe)_x$ layer is thought to be important because it relieves strain at the CdS/ZnTe interface that would otherwise exist due to the excess 10 % lattice mismatch between the two materials. Therefore, it is essential to have a full understanding of the physical properties of $(CdS)_{1-x}(ZnTe)_x$ alloy thin films. In this work, $(CdS)_{1-x}(ZnTe)_x$ thin films in the entire composition range ($0 \leq x \leq 1.0$) were prepared by vacuum thermal evaporation on glass substrate using mixed powders of high purity of CdS and ZnTe compounds as the precursor. XRD revealed that the films exhibited a hexagonal structure with the preferred orientation of (002) plane when $x \leq 0.2$. However, when $x \geq 0.8$, they belonged to a cubic structure with the preferred orientation of (111) plane. For the composition $0.4 \leq x \leq 0.6$, the hexagonal and cubic phases coexisted in the system and the films became less preferentially oriented. SEM and EDS were used to study the surface morphology and elemental composition of the samples. The crystallite size of the as-deposited films in the range 88-361 nm was observed by AFM image. The variation of direct energy gap with composition (x) was in good agreement with the quadratic form, giving a bowing parameter (b) of 0.57 eV. The FTIR transmission spectra in the range 400-1000 cm^{-1} revealed the characteristics of Cd-S and Zn-Te vibrational modes. Electrical properties of the films were evaluated by resistivity and Hall effect measurements in the van der Pauw configuration. From transient photoconductivity measurement, the decay time and its corresponding density of trap states were evaluated.

Keywords: $(CdS)_{1-x}(ZnTe)_x$ thin films, thermal evaporation, optical properties, electrical properties, persistent photoconductivity

DP0015

Advanced analysis of collagen materials in functional drink products: particle size and molar mass by asymmetrical flow-field flow Fractionation

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Abstract

The particle size and molar mass characterizations of soluble macromolecule, such as collagen material, dispersed in functional drink or pharmaceutical formulations. This material is of interest considering the current need of declaring the possible presence on the label of commercial products. The functional drinks are a non-alcoholic drink that contains non-traditional ingredients, which is claimed to provide specific health benefits beyond those of general nutrition. Collagen is a one of choices to add in a functional drink in the enrichment drink group for many benefits as improves health of skin and hair, have anti-aging properties. This research was optimized the separation and analysis methods of Asymmetrical Flow Field-Flow Fractionation (AF4) techniques coupled to a multi-detector system, multi-angle light scattering (MALLS), ultraviolet (UV) and refractive index (RI), respectively, and used to investigate in particle size and molar mass sorting collagen from functional drink matrices. The suspensions, containing the collagen, were separated by AF4 techniques to establish an advanced analysis protocol which applicable for the analysis of collagen particles from three commercial products, sold in Thailand. Furthermore, due to its large size range, it offered the possibility to obtain a number of molecular and conformational properties as well as functional properties over wide size distribution under gentle conditions. Therefore, this protocol suggested that one of the major strengths of the method for food and cosmetics applications in further research.

Keywords: Asymmetrical flow field-Flow fractionation, collagen, functional drinks

Physicochemical properties of biodiesel product derived from lard oil using eggshells as a green catalyst

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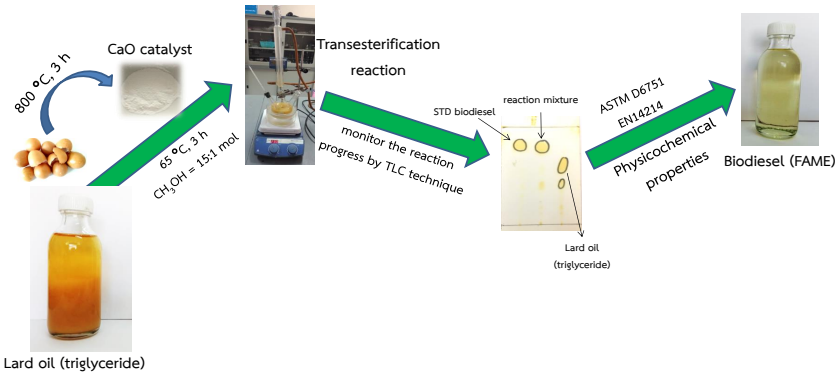
Abstract

Eggshells-derived CaO was used as a catalyst for biodiesel production from lard oil via transesterification reaction. The eggshell materials were calcined in air with the hydrothermal synthesis route at 800 °C for 3 h. Conversion of lard oil to biodiesel product (fatty acid ethyl ester; FAME) was more than 97% by using methanol to oil molar ratio of 12:1, catalyst loading amount of 5 wt.%, reaction temperature of 65 °C and reaction time for 3 h. Physicochemical properties of biodiesel product prepared form lard oil were evaluated according the main property for bio-auto fuels both the ASTM and EN standards namely kinematic viscosity at 40 °C, oxidation stability, methyl ester content, acid number, pour point, cloud point and thermal stability decomposition. All of the physicochemical properties of lard oil biodiesel was compared with palm oil biodiesel, rubber seed oil biodiesel and petroleum diesel. The results in this research showed that lard oil derived biodiesel product has high quality property than palm oil biodiesel and rubber seed oil biodiesel. Therefore, lard oil is one of the attractive candidate feedstock for biodiesel production in Thailand because of its inexpensive, high potentiality and produced high grade biodiesel product.



Graphical Abstract

Keywords: Biodiesel, lard oil, physicochemical properties, eggshells

DP0019

Influence of 1.25 MeV gamma irradiation on the dielectric properties of poly (vinylidene fluoride)/barium titanate polymer nanocomposite

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Abstract

Throughout a decade, calcium copper titanate oxide ($CaCu_3Ti_4O_{12}$: CCTO) has been accepted as an important electroceramic material due to its unique attractive features of giant dielectric permittivity (i.e. $\varepsilon' \sim 10^5$ and 10^4 for single crystal and bulk materials, respectively) together with moderate dielectric loss ($\tan\delta \sim 0.15$) at room temperature [1,2]. This gives promising to be used in a wide range of industrial applications such as capacitor-based devices, electromechanical actuators, and sensors [2,3,4]. However, investigation of an ideal dielectric material offering a huge dielectric constant with a small dielectric loss is continuously concentrated. In addition, irradiation-induced structural transformation in dielectric materials is considerable interest [5–7] this not only brings a perspective on medical dosimetry applications, but also provides fundamental aspects of irradiation-induced changes in electrical properties on perovskite materials. In this study, dielectric properties of pure and Zr^{4+}-substituted CCTO ceramics under gamma irradiation are demonstrated. The CCTO polycrystalline ceramics doped with 5%, 10%, 20% and 30% by weight of Zr^{4+} were prepared using a simple sol-gel method and sintered at 1050 ^oC for 3 hours and further irradiated using a 1.25 MeV gamma source under the dose ranges 0–1500 Gy. The ε' and the $\tan\delta$ of these exposed ceramics are analyzed using an impedance analyzer. The study observes structural changes in both CCTO and Zr^{4+}-doped CCTO ceramics that results in the decreases of ε' and $\tan\delta$ as the radiation dose increased. Changes in micro-structures and primary phase identifications are demonstrated using a scanning electron microscope and x-ray diffraction spectroscopy, respectively. Experimentally, it is found that the grain size of electroceramic decreases with increasing the weight fraction of Zr^{4+} substitution to CCTO. In comparison between non-irradiated and irradiated samples, the study observes gamma-induced changes in phase composition and crystalline size of Zr^{4+}-doped CCTO ceramics, these eventually result in the decrease of the observed ε' values. Possible explanation is due to gamma-induced the increase of amorphous phase, and contrastingly gamma-induced the reduction of the crystallite size of monoclinic and tetragonal zirconia phases in the stabilizer-free samples leading to the increase in density of structural defects [8].

Keywords: CCTO, electroceramics, gamma irradiation, dielectric propertie, phase composition

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DP0022

Synthesis of $BiFeO_3$ nanoparticle prepared by sol-gel method using aloe vera

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Abstract

Synthesis of $BiFeO_3$ nanoparticle prepared by sol-gel method using modified aloe vera solution. The precursor was prepared using $Bi(NO_3)_3.5H_2O$ and $Fe(NO_3)_3.9H_2O$),the radio of aloe vera solution : water (35 g : 100 ml). The precursor were characterized by TGA to determine the thermal composition and then were calcined at different temperatures of 500, 600 and 700 ºC for 3 hours to obtain the powders. The calcined samples were characterized by XRD, FTIR and VSM. The TGA result showed that aloe vera was burned out under 500 ºC. The calcined $BiFeO_3$ at temperatures of 500, 600 and 700 ºC the range of crystalline size was 60, 65 and 92 nm. Room temperature magnetization results showed paramagnetism of $BiFeO_3$ but ferromagnetism at 700 ºC, with saturation-specific magnetization values in the range of 0.11–0.18 emu g^{-1} at 10 kOe.

Key words: Bismuth ferrite; Sol gel; Nanoparticles; Magnetic properties

DP0026

Synthesize, characterization and magnetic properties of nanoparticle nickel ferrite ($NiFe_2O_4$) by sol-gel method using aloe vera

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Abstract

$NiFe_2O_4$ powders were synthesized by Sol-gel using $Ni(NO_3)_2.6H_2O$, $Fe(NO_3)_3.9H_2O$ and freshly extracted Aloe-Vera (ovalbumin) in aqueous medium. The precursor was calcined at 500, 600 and 700 °C in air for 3 h to obtain nanocrystalline powders of $NiFe_2O_4$. The calcined $NiFe_2O_4$ powders were characterized by XRD, TGA, FT-IR and VSM. The XRD results indicated that all calcined samples have a typical spinel ferrite $NiFe_2O_4$ structure, No diffraction peaks of other impurities such as α-Fe_2O_3 or NiO were observed. The formation of the spinel $NiFe_2O_4$ structure in the nanocrystalline $NiFe_2O_4$ samples was further supported by FTIR spectra. The crystalline sizes of $NiFe_2O_4$ were in the range of 12.46-19.87 nm. Room temperature magnetization results showed a ferromagnetic behavior of the $NiFe_2O_4$ nanoparticles, with saturation-specific magnetization values in the range of 15.22–17.35 emu g^{-1} at 10 kOe.

Key words: Nickel ferrite, sol gel, nanoparticles,magnetic properties

DP0027

Enhancement of biodiesel synthesis using acid treated golden apple snail shell-derived CaO as economical and green heterogeneous catalyst

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Abstract

High purity calcium oxide (CaO) material was synthesized via the acid treated golden apple snail shell to use as a catalyst for the biodiesel production with transesterification of palm oil. The golden apple snail shell was reacted with hydrochloric acid (HCl) to prepare calcium chloride ($CaCl_2$). Then, the obtained $CaCl_2$ was mixed against sodium carbonate (Na_2CO_3) for sedimentation of high purity calcium carbonate ($CaCO_3$) phase. In the final step, high purity $CaCO_3$ material was converted into CaO as a catalyst by calcination in a furnace at 800 °C for 3 h. XRD, BET by N_2 adsorption, SEM-EDX, TGA, Hammett indicator method and CO_2-chemisorption techniques were used to analyze the physicochemical properties of the obtained CaO catalyst. The high purity CaO catalyst obtained from golden apple snail shell resulted high conversion of palm oil to fatty acid methyl ester (FAME) over 95% conversion under the optimal reaction conditions of catalyst loading amount of 5 wt.%, methanol/oil molar ratio of 12:1, reaction temperature 65 °C and reaction time for 3 h. While CaO catalyst derived from untreated golden apple snail shell gave biodiesel only 79% under the same reaction condition. High-quality biodiesel product after treatments process showed physicochemical properties according requirements of all the ASTM and EN standard specifications. All of the results indicated that treatment golden apple snail shell before calcination process directly affected on enhancement catalytic activity of the CaO catalyst.

Graphical Abstract

Keywords: golden apple snail shell,treated,green heterogeneous catalyst, biodiesel

DP0030

I-V characteristics of Au/ZnO/Au and Au/Sb-doped ZnO/Au double-junction structure

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Abstract

ZnO is typically an intrinsic n-type semiconductor by nature. However, its electrical property can be changed from n-type to p-type by doping with suitable cathodic metal such as antimony. In this work, we experimentally investigate the electrical properties by mean of current-voltage (I-V) measurement of Au/ZnO/Au and Au/Sb-doped ZnO/Au double-junction structure with variation of dopant concentration. The gold electrode was coated on glass substrate by DC sputtering technique. after that ZnO or Sb-doped ZnO were deposited on the gold electrode by sol-gel spin coating technique followed by annealing process at 500 °C for 2 h. Structural and morphological properties of samples were investigated by X-ray diffractometer (XRD) and scanning electron microscope (SEM). the characteristics of metal/metal oxide/metal with variation of dopant concentration will be discussed.

Keywords : Sb-doped ZnO; I-V characteristic; Double-junction

DP0031

Effect of O_2 plasma treatment on optical properties of Cu-doped SnO_2 thin films by O_2 plasma treatment

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Abstract

Cu-doped SnO_2 thin films were deposited on glass slide substrate using RF magnetron sputtering method. The effects of O_2 partial pressures in the deposition process and post O_2 plasma treatment were investigated for the optical properties. Their optical properties of film depend on its microstructure, composition, surface roughness and crystal defects, which are a result of fabrication process. The deposition condition was as following: O_2 partial pressures of 0–10%. Post-plasma treatment was carried out using O_2 flow rate of 15 mL min^{-1}, annealing temperature of 420 °C and treatment time of 30 min. Optical transmission spectra show that the films deposited at higher O_2 partial pressures have higher transparent and increasing band gap from 3.08–3.78 eV. After O_2 plasma treatment, the films show better than optical transmission of the films deposited. But the optical transmission of the films at 10% was decreased which a result of its was to outstanding of a high roughness of their films.

Keyword: O_2 plasma treatment, Cu-doped SnO_2, O_2 partial pressures

DP0033

Effect of milling speed and time on ultrafine ZnO powder by high energy ball milling technique

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Abstract

The particle size of commercial zinc oxide (ZnO) powder has been found in micron scale. For the improvement of ZnO properties, size reduction in nanoscale is required to overcome its disadvantage. In this work, the particle size of ultrafine ZnO powder was focused on high energy ball milling technique. As-prepared ZnO powder was used as a commercial grade with average size 0.8 μm. Milling speed and time in high energy milling process were the crucial parameters that affected on size reduction of ZnO particles. Crystalline structure, surface morphological and particle size were investigated by X-ray diffractometer (XRD), scanning electron microscopy (SEM) and particle analyzer, respectively. The preliminary results suggested that ZnO patterns after milling process with various milling speed and time were identically in hexagonal crystalline phase affirmed by XRD result. SEM images indicated ZnO products in each condition distinctly decreased its size according to the increase of milling time and speed. ZnO particle size after milling process was found in ultrafine power in range of 200−400 nm following by particle size analysis. These results can be interpreted that particle size of the commercial ZnO powders is effectively minimized to few hundred nanometer range depending on force attraction and suitable rotation during milling process with specific speed and time. Moreover, the significant milling parameters will be studied to find the optimum condition for the production of ZnO particles in nanoscale.

Keywords : High energy ball milling; milling speed; milling time; ultrafine powder; zinc oxide

DP0035

The influence of Si/Al ratio in zeolite Y structure for methane and carbon dioxide adsorption

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Abstract

The adsorption of methane and carbon dioxide on zeolite Y with various Si/Al ratio were studied. The zeolite Y was synthesis with the Si/Al ratio of 2.43 and the other Si/Al ratios as 10, 100 and 750 were the commercial. The Si/Al ratios was characterized by ICP technique and the surface properties were performed by BET, t-plot, pore volume and pore size distribution methods. The characterization results in the Si/Al ratio as 2.43, 9.74, 102.95 and 754.76 with the decrease of BET surface area, micropore surface area, pore volume and pore size in the Si/Al ratios increasingly. The methane adsorption results showed that the less amount of methane adsorbed onto zeolite surface at all studied Si/Al ratios. In contrast, the carbon dioxide results in the higher adsorbed amount than methane. The carbon dioxide adsorbed on zeolite Y increase with the decreasing of Si/Al ratio but the lower ratio required the degassed process to remove water and other impurity before use. The field test was preliminary tested by purification of methane form biogas. The good results were obtained, it is showed the percent of methane after flow through zeolite Y was increase from 43.44% to 76.91%.

Keywords: methane adsorption, carbon dioxide adsorption, zeolite Y

DP0037

Structural and optical properties of C-Bi_2O_3 microrods synthesized by hydrothermal method

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Abstract

C-Bi_2O_3 microrods were successfully fabricated through a facile hydrothermal method. This work developed a simple route to fabricate C-Bi_2O_3 in a single step. The structural and optical properties of C-Bi_2O_3 microrods were studied. XRD results confirmed the monoclinic phase of bismuth oxide. The average crystallite sizes of the pure Bi_2O_3 and C-Bi_2O_3 were investigated. Their microstructures were characterized by Raman spectroscopy. Photoluminescence and UV-visible diffuse reflectance spectra showed good optical properties. Increasing the amount of carbon led to a significantly increase in the absorption in the visible light region compared with the pure Bi_2O_3. The optical band gap of prepared samples was also calculated.

Keyword: Bismuth oxide, optical properties, carbon

DP0038

Acid Functionalized silica/sulfonated tetrafluoroethylene based fluoropolymer composite membranes for PEMFCs

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Abstract

In this work, spherical silica nanoparticles were chemically modified by acidic species which are concentrated sulfuric and phosphoric acids in order to enable their ion conductivity as a conductive nanofiller. Subsequently, sulfonated tetrafluoroethylene-based fluoropolymer and functionalized silica were prepared as composite membranes by solvent casting aiming at proton exchange membrane fuel cells application at high temperature and low humidity operating condition. After fabrication, membrane properties related to proton exchange membrane fuel cells application including ionic conductivity, water uptake, thickness expansion, thermal stability and morphology were characterized. Due to an existence of acidic groups on the silica surface verified by thermogravimetric analysis and Fourier-transform infrared spectroscopy techniques, the composites with functionalized silica perform better ionic conductivity than one with pristine silica. At 1% loading, homogeneous nanoparticle dispersion was achieved resulting in relatively good ionic conductivity. The composite membranes show excellent thermal stability up to 250 °C, which allows an operation at high temperature condition. Moreover, an enhancement of water retention of composite membranes due to acidic groups on silica surface enables them to function in low humidity condition.

Keywords: Nafion composite, functionalized silica, proton exchange membrane fuel cell

DP0039

Influence of calcination temperature on physical and electrochemical properties of MnO_2 nanoparticles synthesized by co-precipitation

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Abstract

Manganese dioxide nanoparticles were successfully synthesized by co-precipitation method using manganese acetate and potassium permanganate as the starting materials and calcined at 200−500 ºC for 4 h in ambient air. Structural, morphological and electrochemical properties of all samples were investigated by X-ray diffraction technique (XRD), scanning electron microscope (SEM) and cyclic voltammetry technique (CV), respectively. The symmetric electrochemical cells were fabricated on 304-stainless steel as the electrode by doctor blade technique using polyvinylpyrrolidone (PVP)-KI, PVP-Na_2SO_4 and PVP-$LiClO_4$ as the gel electrolyte. The XRD results reveal that tetragonal structure of MnO_2 can be synthesized by co-precipitation process with calcinations temperature at 400 ºC for 4 hr. SEM images indicate that the size of MnO_2 quasi-spherical powders are in nanoscale and transform into short rod under calcination temperature at 500 ºC. The electrochemical properties results indicate that the electrochemical cell of MnO_2 calcined at 300 ºC with PVP-KI as the gel electrolyte shows a highest specific capacitance about 90.87 F g^{-1} at a scan rate of 100 mV s^{-1}.

Keywords: Physical properties, electrochemical properties, MnO_2, co-precipitation method

DP0042

Copper K-edge XAS study of copper transformation behavior during annealing of delafossite $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$

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Abstract

In this work, delafossite $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$ powders were synthesized by a solid-state reaction method. The powders were annealed in air at 550 ˚C for 1 h. The effects of annealing on the crystal structure of $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$ powders were investigated by X-ray diffraction (XRD). $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$ powders show a single phase of the delafossite structure, both before and after annealing. X-ray absorption spectroscopy (XAS) studies were used to measure the atomic-ion concentrations of Cu^{2+} and Cu^{1+} of delafossite $CuAlO_2$ and $CuAl_{0.9}Fe_{0.1}O_2$ powders during and after the annealing process. After annealing, the amounts of Cu^{2+} ions in delafossite $CuAlO_2$ has not changed. For delafossite $CuAl_{0.9}Fe_{0.1}O_2$, the amounts of Cu^{2+} ions increase after annealing due to the substitution of Fe into Al sites.

Keywords: $CuAlO_2$, time-resolved XAS, copper transformation

DP0043

The performance of synthetic zeolite combined with activated carbon for removal of linuron herbicides

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Abstract

The research was to study the efficiency of linuron herbicide from wastewater by three types of adsorbents. They were 1) synthetic zeolite NaY combined with activated carbon (SZA) 2) synthetic zeolite NaY with activated carbon and modified with 6M HDTMA surfactant (MSZA) and 3) synthetic zeolite NaY (SZ). Moreover, the batch adsorption factors were: 1) adsorption time 2) adsorbents dosage 3) initial linuron concentration and 4) adsorption isotherm. The results showed that the adsorption of linuron herbicide of all adsorbents increased rapidly and approach to equilibrium at 24 h. When the amount of adsorbent increased, it was found that adsorption of linuron herbicide increased and the maximum adsorption efficiency was at 0.1 g. As the initial concentration of linuron increased, the adsorption capacities of linuron were increased as well. However, the percentage of adsorption began to stabilize at a concentration of 1 ppm linuron. The maximum adsorption efficiency of SZA, MSZA and SZ were 47.575 %, 48.742% and 55.962%, respectively. The Langmuir adsorption isotherm and characterization of adsorbents by XRD, FT-IR and particle size technique were studied. In summary, zeolite synthesis combined with activated carbon (ZSA) has efficiency in adsorbing linuron herbicide and as an alternative to elimination pesticide, herbicide, organic toxins and other wastes released into the environment.

Keywords: Zeolite, activated carbon, linuron, herbicide, environment

DP0044

Enhanced visible light photocatalytic activity of TiO_2 hybrid with natural Ilmenite nanocomposites

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Abstract

The activated ilmenite nanocomposite of TiO_2 hybridized were prepared by natural ilmenite and commercial TiO_2 anatase assembled using sugar as cross-link agents and carbon source. The heterostructure interface of anatase-ilmenite junction, crystallinity and chemical state were characterized by X-ray diffraction (XRD), UV-Vis diffuse reflectance spectroscopy and X-ray photoelectron spectroscopy (XPS). Composite morphologies and structures were investigated by field emission scanning electron microscope (FESEM). Synergistic of low energy gap in range of visible light and interfacial charge separate from TiO_2 to ilmenite junction was evaluated in photocatalytic degradation of organic dye. The result from visible light catalytic dye degradation suggests that narrow bandgap energy is associated to ilmenite phase, carbon sensitization, low recombination rate of generated electron-hole pair transfer.

Keywords: TiO_2 hybridized, natural ilmenite, nanocomposite

DP0046

The method of sintering process for piezoelectric tape ceramic

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Abstract

Piezoelectric multilayer ceramic (PMC) is made laminated green tape stacking thin tape. The ceramic tape is one of many methods to fabricate piezoelectric actuator. Generally, sintering green tape presents rather wrap and high porosity matter. In this present, the piezoelectric multilayer ceramics tape of $Pb_{0.965}Sr_{0.02}Bi_{0.02}[(Zr_{0.52}Ti_{0.48})_{0.99}Nb_{0.01}]O_3$ (PSBZTN) was fabricated using tape casting method. The uniform green tape thickness 300 μm was stacked into PMC. After annealing and burnout of a binder, the alumina plate and various solid loading was applied cover the PMC protecting wrap of laminar and multilayer ceramic in sintering process. The porous decreased after sintering which was obtained by optimizing the loading. The PSBZTN calcination powder deposition ceramic tape was benefit in sintering processing. The PMC was also able be processed in sandwich by sheet of calcination powder deposition between PMC and cover alumina plate which employed to maintain the flatness and to reduce the porous of PMC.

Key word; Piezoelectric multilayer ceramic, piezoelectric actuator, ape casting, wrap, porosity

DP0047

Influence of anodized voltage on topography and surface wettability of TiO_2 nanotubes fabricated by electrochemical anodization

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Abstract

Titanium dioxide nanotubes (TNTs) were fabricated on titanium sheet by electrochemical anodization in an ethylene glycol solution containing NH_4F and DI water for 6 hr. An anodized voltage was varied between 35–65 V. The microstructure, topography and wettability of TNTs were characterized by X-ray diffraction (XRD), field-emission scanning electron microscopy (FE-SEM), and contact angle analyzer, respectively. It was found from XRD measurements, TNTs exhibit an amorphous structure of TiO_2 with the existence of typical diffraction peaks of metallic titanium. TNTs fabricated on titanium substrate were arranged uniform, neatly, and highly ordered structure. The range of inner diameter was about 100–190 nm as the anodized voltage was increases from 35–65 V. This result can be explained by the electric field induced construction mechanism of TNTs. In addition, the contact angle of TNTs increased from 12.3–116.5° as the anodized voltage was increases from 35–65 V. This result indicated that the anodized voltage is the key factor to control diameter and wettability of TNTs.

Keywords: TNTs, electrochemical anodization, anodized voltage, surface wettability

DP0049

Multi state Mn_3O_4 hausmannite-carbon nanocomposites derived from carbonization of nano-manganese oxide-cellulose

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Abstract

Multi state Mn_3O_4 hausmannite-Carbon nanocomposites was prepared form carbonization of hybrid nano-Mn_3O_4/cellulose composite. Crystal structure and atomic local environment were investigated by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and X-ray absorption spectroscopic (XAS). Surface oxidation state and binding were study by X-ray photoelectron spectroscopy (XPS). The particle morphology and structure were characterized by field emission scanning electron microscope (FESEM) and transmission electron microscope (TEM). Electrochemical capacitive property of active species was tested by cyclic voltammetry (CV). The main phase of nano-Mn_3O_4 hausmannite in carbon exist as amorphous of Mn_3O_4 hausmannite local symmetry and the secondary phase exist as crystalline Mn_3O_4 hausmannite. The Nanocellulose show effective as binder and carbon source for manganese oxide nanohybrid material synthesis which can control phase structure and crystal growth. The nano-Mn_3O_4 show strong contact and well dispersed in carbon with surface multi Mn state as Mn^{2+}, Mn^{3+} and Mn^{4+} species. The Mn_3O_4-carbon nanocomposites sample demonstrating better electric double layer and pseudocapacitive performance.

Keywords: Mn_3O_4, carbon, cellulose, nanocomposites

DP0050

Effect of fuel content on dielectric and piezoelectric of KNLNTS ceramics prepared by the combustion technique

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Abstract

In this study, lead-free $(K_{0.44}Na_{0.52}Li_{0.04})(Nb_{0.84}Ta_{0.10}Sb_{0.06})O_3$ KNLNTS ceramics were synthesized by the solid state combustion technique using glycine as the fuel. Different fuel-to-oxidizer ratios were found to be a key factor of the process. The raw material powders were well-mixed with the fuel (glycine) in the ratio of 1:0, 1:0.5, 1:2, 1:3 and 1:9 by weight. The powders and ceramics were calcined and sintered at 650 °C for 2 h and 1100 °C for 2 h, respectively. The average particle size approximately 0.35 μm was obtained in all calcined powders. Pure phase was found in all sintered samples. The microstructure of KNLNTS ceramics exhibited a square and rectangle in shape. The dielectric constant at Tc increased from 2520 to 7337 when fuel content increased from 0 to 2 and then dropped in value. The highest dielectric (7337), the lowest loss tanδ (0.028), the densest (4.33 g cm^{-3}) and piezoelectric constant (d_{33}) of 205 pC N^{-1} were obtained by the sample using the fuel-to-oxidant weight ratio of 1:2.

Keywords: KNLNTS, combustion technique, dielectric, piezoelectric

DP0051

Characterization of $BiVO_4$ nanoparticles prepared by sonochemical process

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Abstract

Nowadays, environment encounters various pollutants including toxic gases, organic volatiles and water pollutant. Many scientists tried to reduce pollutant by degradation of organic volatile using photocatalytic materials. Bismuth Vanadate is one of attractive photocatalyst material because of its excellent photocatalytic activity driven under visible light illumination. This article was carried out to synthesize $BiVO_4$ nanoparticles by simple but effective method via sonochemical process through chemical route assisted by ultrasonic irradiation. The crystalline structure and surface morphologies of the synthesized products were observed by X-ray diffraction technique and Scanning Electron Microscope, respectively. Particles sizing analyzer and UV-Visible spectroscopy were used to approve the $BiVO_4$ particle size and relevant optical properties. Photocatalytic activity was studied by using degradation of organic dye assigned as organic compound under visible light irradiation.

Keyword: Bismoth vanadate, nanoparticles, sonochemical process, photocatalyst

DP0053

Synthesis, morphology and optical properties of perovskite-type oxides $La_xSr_{1-x}FeO_3$ synthesized by sol-gel auto-combustion method

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Abstract

The perovskite-type oxides $La_xSr_{1-x}FeO_3$ (LSF-*x*) with x = 0, 0.02, 0.04, 0.06, and 0.1 were prepared using the sol-gel auto-combustion method. The effect of Sr substitution on the phase was characterized with an X-ray diffractometer. The crystalline structure and phase formation of the LFS-*x* were also investigated using Rietveld refinement analysis in FullProf Suit software. The morphology and chemical composition of the samples were comprehensively examined with a scanning electron microscope equipped with an energy dispersive X-ray analyzer. The excitation and emission stages of the five variants of LSF-*x* were investigated using fluorescence spectroscopy. The electrical properties, including the dielectric constant, strain and ferromagnetic properties, were also determined. As a result, the phase formation of each sample was confirmed to be a perovskite $LaFeO_3$ structure. The Sr-doped $LaFeO_3$ was found to have no impurities. The particles of LSF are relatively homogenous with the average size on the nanoscale. The quantitative EDX analysis confirms that the chemical composition of the undoped and doped $LaFeO_3$ samples is in good agreement with the nominal composition. The photoluminescence (PL) of the samples excited by 310 nm wavelength at room temperature is ~380 nm. The electrical property was presented and discussed. Therefore, the present study will be of great value in preparing perovskite-type oxides $La_xSr_{1-x}FeO_3$, together with optical and electrical properties.

Keywords: $LaFeO_3$; Sr-doped $LaFeO_3$, perovskite, morphology; optical property; sol-gel auto-combustion method

DP0056

Preparation of the $MAPbBr_3$ perovskite films by the one-step spin coating method for solar energy conversion devices

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Abstract

Methylammonium lead tribromide ($MAPbBr_3$) perovskite films were prepared by the one-step spin coating method. The spin coating solutions were prepared by the mixing of lead dibromide ($PbBr_2$) and methylammonium bromide (MABr) in dimethylformamide (DMF) solution. The effect of precursor concentration (0.5 M, 1.0 M, 1.4 M) on the surface morphology of $MAPbBr_3$ film and solar cell performance were studied. The optical energy bandgap (E_g) of $MAPbBr_3$ films was estimated from the Tauc plot method. The results show that there is no difference in the E_g of $MAPbBr_3$ films prepared with various concentration. The E_g of all samples is about of 2.29 eV was observed. The surface morphology of the 1.0 M $PbBr_2$: MABr (1:1) in DMF solvent sample shows higher homogeneous than others concentration. The maximum solar cell efficiency based on the one-step spin coating of the $MAPbBr_3$ perovskite film prepared with 1.0 M precursor concentration reached 1.09%, respectively.

Keywords: Perovskite solar cell, $MAPbBr_3$, one-step spin coating

DP0059

The Fe_3O_4 nanoparticles on heavy metals determination application

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Abstract

In this study, magnetic Fe_3O_4 were synthesized by simple co-precipitation method. The crystal structure of as-prepared sample was determined using XRD. The XRD result is well accordance with the magnetite phase of Fe_3O_4. The morphology and size of the particles were observed by TEM. And the spherical particles have a mean size around 30 nm. Its application in the preconcentration of metal ions. The parameters affecting the preconcentration were optimized. Eluent and elution time were selected as effective factors of elution step in the optimization study. Following the sorption and elution, the ions were quantified. After preconcentration, the magnetic Fe_3O_4 could be easily removed from the solution. The sol of SDS@Fe_3O_4 was also prepared and investigated for the ability on preconcentration of heavy metals.

Keywords: Fe_3O_4 nanoparticles, heavy metals

DP0060

Effectiveness of composites materials between chitosan and $CaCO_3$ from animal shells and SiO_2 powder to humidity sensor and electrical properties

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Abstract

The calcium carbonate ($CaCO_3$) and chitosan were prepared from eggshells and shrimp shells powder, respectively. The rice husk ash is raw material of SiO_2 powder. The ratios of eggshells and shrimp shells powder and SiO_2 powder are (a) 2: 0: 0.25, (b) 0: 2: 0.25 and (c) 1: 1: 0.25, respectively. All of specimens of those conditions were to be pills by home made machine before crystals structure were characterized by X-ray diffractometer (XRD) techniques. The XRD patterns of samples showed $CaCO_3$ and chitosan. The humidity sensor and electrical properties were verified. The electrical property results found that all specimens are Ohmic's material. The humidity versus resistivity curve of sample (b) have the highest resistivity at relative humidity range of 45−65% RH. In other hand, this sample showed lowest resistance. Consequently, the ratio of composites materials between chitosan and $CaCO_3$ from animal shells and SiO_2 powder are importance and play a key role.

Keywords: Chitosan, $CaCO_3$, humidity sensor, eggshells, shrimp shells

DP0061

The Organometal Halide Perovskite Films Prepared by DMF Additive in Two-Step Ambient Air Solution Processes

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Abstract

It is crucial importance on commercialization of organometal halide perovskite for increasing efficiency is more than 20%. However, its stability in humid air for perovskite solar cells is a lack of effective solution to the problem until now. Hence, we prepared the precursor solution using PbI_2/DMF in small amount of DMSO as well as MAI/IPA concentration with varying 1–4% of DMF. According to the ambient air, new XRD peaks appeared at low angle cannot be assigned for $MAPbI_3$ and PbI_2. We can solve the problem for PbI_2 sample adjusted by dipping time in MAI/IPA solution. Low and high concentration of MAI can affect the crystallization of perovskite film. Another way to solve by spin coating films caused the formation of perovskite phase can observe in increasing MAI/IPA concentration as well as annealing temperature. Annealing temperatures were changed from 100–200 °C as started in 0 s to 30 min. Vacuum and air annealing methods are mainly attributed differently to the stability of fast solvent evaporation process. The stability of devices was tested in ambient air for 336 h (14 days). The strong peaks at 14.08° (110) and 28.41° (220) of the perovskite phase annealed in vacuum for 15 min are more stable on the effects of humidity exposure.

Keywords: Perovskite solar cells;crystallization;DMF and DMSO

DP0063

Tuning optical absorption property of core-shell structured TiO_2@Ag nanowire and nanosphere

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Abstract

Nanoparticles (NPs) with nonmetallic core and a metallic shell (such as Au, Ag, and Cu) can improve the absorption efficiency due to the localized surface plasmon resonance (LSPR), charge density oscillations at the surfaces of these core-shell composite nanoparticles. In this study, the effect of geometry of Ag@TiO_2 core-shell composite nanoparticles on the optical absorption properties was theoretically illustrated in the wavelength 300-1000 nm of the electromagnetic wave. These nanostructures were modeled by varying the TiO_2 core and Ag shell radii of the composite nanospheres and nanowires. The results indicate that varying the TiO_2 core radius can be tune the absorption efficiency. The increasing of absorption efficiency with increasing core radius were observed. While the absorption efficiency peaks of core-shell nanospheres or nanowires increase with increasing shell radius. Theoretical modeling based on optical absorption property results suggest that this nanomaterial can be efficiently utilized for tuning the optical absorption properties. The properties could help to synthesis Ag@TiO_2 core-shell composite NPs for utilizing in environmental applications (such as cleaning the contaminated water) and new functional devices in the future.

Keywords: TiO2@Ag Core-shell nanostructure, absorption property, localized surface plasmon resonance

DP0064

Tuning optical and magneto optical properties of core-shell structured Fe@Au nanoparticles

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Abstract

Magnetic nanoparticle nanoparticles have attracted a great deal of attention due to its possible uses in many applications biomedical applications such as targeted drug delivery, sensing, and ultra-sensitive disease detection. In this study, theoretical calculating based on optical absorption property of Fe@Au core-shell nanoparticle (NP) embedded in polymethylmethacrylate (PMMA) host was investigated in the wavelength of 300−1000 nm of the electromagnetic spectrum. The obtained results demonstrate that these core-shell nanoparticles can be tuned surface plasmon (SP) resonance peak that depends on the ratio of the core radius to the total radius. There is a red-shift of SP peak position with a decrease of the shell thickness and a blue-shift with an increase of the shell thickness. The calculated Faraday rotation of Fe@Au core-shell NP was found that it exhibits different behavior in each incident wavelength. These findings could be utilized as basic knowledge for synthesis method to obtain the suitable Fe@Au core-shell NP in the future application works.

Keywords: Fe@Au core-shell nanostructure, optical absorption property, magneto optical property, localized surface plasmon resonance

DP0065

Dielectric and ferroelectric properties of piezoelectric tape PZT–SKN

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Abstract

The $[0.98Pb(Zr_{0.52}, Ti_{0.48})O_3–0.02Sr(K_{0.25}, Nb_{0.75})O_3]$ ceramics (PZT–SKN) were synthesized by powders of PbO_2, ZrO_2 , TiO_2, K_2CO_3, $SrCO_3$ and Nb_2O_5 by solid state reaction method. Then the invention of the tape by tape casting method. Then examine the crystalline structure of PZT–SKN tape ceramic by X-ray diffraction, measuring density and Vickers Hardness, examine the dielectric and ferroelectric property of PZT–SKN tape ceramic. The PZT–SKN tape ceramic have crystal structure of Perovskite type tetragonal and hexagonal lattice parameter a = b = 4.036 Å, c = 4.138 Å and c/a = 1.025. The density = 6.035 g cm^{-3} and Vickers Hardness = 107 N mm^{-2}. The dielectric constant of PZT–SKN tape ceramic the ε_r = 1499 at 532 °C. The dielectric and ferroelectric property of PZT–SKN tape ceramic show behavior better compared to PZT–SKN tablet ceramic.

Keywords: Dielectric, ferroelectric, PZT–SKN, piezoelectric tape

DP0066

Luminescence properties of Dy^{3+} ions doped in B_2O_3-Al_2O_3-CaO-Na_2O glass for Solid state lighting applications

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Abstract

This research, the luminescence properties of borate glasses doped with Dy_2O_3 concentration have been investigated. The glass samples with chemical composition of $(40–x)B_2O_3 : 20Al_2O_3 : 20CaO : 20Na_2O : xDy_2O_3$ (where x = 0.00, 0.05, 0.10, 0.50, 1.00, and 2.00 % by mol) were prepared by the normal melt-quench technique. The results show that the density and molar volume increased with increasing of Dy_2O_3 concentration. The excitation spectra are observed seven bands at 325, 351, 364, 387, 425, 452 and 472 nm corresponding to the transitions from the ground state $^6H_{5/2}$ to $^6P_{3/2}$, $^6P_{7/2}$, ($^4I_{11/2}$+$^4P_{3/2}$), ($^4I_{13/2}$+$^4F_{7/2}$), $^4G_{11/2}$, $^4I_{15/2}$ and $^4F_{9/2}$ excited states, respectively. The emission spectra were recorded in the wavelength region 500–750 nm using 350 nm excited wavelength. The emission peaks are observed at 482 ($^4F_{9/2} \rightarrow {}^6H_{15/2}$), 576 ($^4F_{9/2} \rightarrow {}^6H_{13/2}$) and 664 ($^4F_{9/2} \rightarrow {}^6H_{13/2}$) nm. The tunable white light emission at different excitation wavelengths are investigated through CIE 1931 diagram. The decay curves show the decreasing of lifetimes when addition of Dy_2O_3 concentration.

Keyword: Glass, Luminescence, Dysprosium

DP0067

Radiation shielding of $BaO:WO_3:Na_2O:B_2O_3$ glass system by WinXCom program in the range of 1 keV to 100 GeV: theoretical calculation

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Abstract

This theoretical research aimed to study the radiation shielding properties of $BaO:WO_3:Na_2O:B_2O_3$ glass system when (BaO = 5, 10, 15, 20, 25, 30 and 35 mol%) of this glasses. Those were theoretically calculated by using WinXCom program in the range 1 keV to 100 GeV of the energy regions. The results of calculation found that the mass attenuation coefficients were increased with the increasing of BaO concentration and decreased with the increasing of the energies. Moreover, the borate glasses system at the low energies discontinuities correspond to photoelectric absorption edges of tungsten and barium. For the partials interaction at the low energies range the photoelectric absorption is the main interaction in these energy regions. At the medium energy regions, the radiation shielding parameters are almost constants dominated by Compton scattering process. In the high energy regions, pair production becomes the main interaction process over the energy. It can also be concluded that the characteristics of radiation shielding parameters for the glasses system depend on different barium in this concentration and the energy regions.

Keywords: borate glasses; radiation shielding parameter, the mass attenuation coefficient, partial interaction

DP0073

Fabrication and study on optical and photoluminescence properties of europium doped in borate glasses

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Abstract

The influence of trivalent europium (Eu^{3+}) ion on the optical and photoluminescence properties of zinc barium borate glasses prepared in different conditions are studied of the (60-x)B_2O_3-30BaO-10ZnO-xEu_2O_3 with $0.5 \leq x \leq 2.5$ (in mol %) glass system prepared by conventional melt quenching technique and their physical, optical and photoluminescence properties were investigated. The UV-VIS-NIR absorption spectra were recorded at room temperature in the wavelength range of 200-2,500 nm. The intensity of all absorption bands increased with increasing of Eu_2O_3 contents. In addition, the photoluminescence properties of Eu^{3+}-doped ZnO-BaO-B_2O_3 glass system were carried out using excitation wavelengths of 394 nm. Five photoluminescence bands were observed at 579 nm ($^5D_0 \rightarrow {}^7F_0$), 589 nm ($^5D_0 \rightarrow {}^7F_1$), 613 nm ($^5D_0 \rightarrow {}^7F_2$), 651 nm ($^5D_0 \rightarrow {}^7F_3$) and 702 nm ($^5D_0 \rightarrow {}^7F_4$). The intense peak (red orange emission) of the glasses was found at 613 nm. This study should be considered as a potential candidate for applications in laser or optical devices

Keywords: Optical property, photoluminescence property, Europium, borate glasses

DP0075

Theoretical calculation of mass attenuation coefficient and radiation shielding parameters of WO_3-TeO_3 glasses

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Abstract

In this study, the photon interactions of WO_3-TeO_3 glass system have been calculated using WinXCom program at energy 1–10^3 keV. The mass attenuation coefficient (μm) and the partial interactions were presented. The results show that the values of μm increased toward the decrease of gamma ray energies, indicates the dependence of the mass attenuation coefficient values on the photon energy. The partial interactions found that three energy ranges relative to the partial processes photoelectric absorption, Compton scattering and coherent scattering. These glass sample was observed that the photoelectric absorption found to be the main interaction of energy range. The discontinuous of glass sample illustrate that it occur from photoelectric absorption edge of sample element compositions at low photon energies. The coherent scattering found to be significant at low photon energy and rapidly decreases with increasing of photon energy but the Compton scattering, the values was slightly increase with increasing of photon energy.

Keywords: Borate glasses, radiation shielding parameter, the mass attenuation coefficient, partial interaction

DP0076

The physical and optical properties of glasses from local sand in Nakhon Pathom province

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Abstract

In this work, local sand in Mueang and Kamphaeng Saen district of Nakhon Pathom Province were used as raw material in glasses. The glass samples were prepared in formula $45SiO_2$: $20B_2O_3$: 10BaO : $25Na_2O$ by melt and quenching technique. Four difference raw SiO_2 of glass samples were prepared by local general (GM) and fine sand of Mueang (FM) and local general (GK) and fine sand of Kamphaeng Saen (FK). These samples were investigated physical and optical properties to compared with glass from high silica commercial grade (GS). The density and refractive index values of glass from local sand have close to GS around 2.66–2.67 g cm^{-3} and 1.5376–1.5391, respectively. The Vicker's hardness of glasses were in good acceptable values around 393.2–465 HV. While, the optical properties of glasses from local sand were differed to GS. The absorption spectra of glasses from local sand were occurred the contamination of Fe^{2+} and Fe^{3+} ions in wavelength of 440 nm and 1050 nm. This contamination of iron oxide was obtained from local sand. However, this experiment demonstrates that possibility of utilizing local sand in glass production.

Keywords : Glass, local sand, quartz

DP0078

Comparative study of physical, optical and gamma-ray shielding properties at 662 keV of $BaO\text{-}La_2O_3\text{-}B_2O_3$ and $BaO\text{-}Na_2O\text{-}B_2O_3$

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Abstract

In this work, barium lanthanum borate glasses with composition $xBaO: 20La_2O_3: (80-x)B_2O_3$ and barium sodium borate glasses with composition $xBaO : 20Na_2O_3: (80-x)B_2O_3$ (where x = 15, 20,25 and 30 mol%) have been prepared using melt-quenching method. Their physical optical and the gamma-ray shielding properties were investigated and compared with theoretical calculation. ^{137}Cs source has been used for experimental measurements of the mass attenuation coefficient for gamma-ray at 662 keV and theoretically calculated using WinXcom program. The densities and the molar volumes increased with increasing BaO concentration. The optical spectra of the glasses show the high transparency in visible region. For gamma-ray shielding properties, the mass attenuation coefficients were increased with increasing BaO concentration. Our result showed relative difference between theory and experiment of less than 1% between experimental and theoretical values. The mass attenuation coefficients of $BaO\text{-}La_2O_3\text{-}B_2O_3$ glass system were greater than $BaO\text{-}Na_2O\text{-}B_2O_3$ glass system. The Half-value layers (HVL) at 662 keV were found to decrease with increasing BaO concentration. All studied glasses have the HVL values lower than some standard shielding, concretes and commercial window, indicating the potential of the prepared glasses as a radiation shielding materials.

Keywords: Mass attenuation coefficient, gamma-ray, shielding, glass

DP0085

Phase transition, electrical properties, and temperature insensitive large strain in [(0.935-*x*)BNT-0.065BT-*x*BZT] lead-free piezoelectric Ceramics

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Abstract

Lead-free piezoelectric composition ceramics of [(0.935–*x*)BNT-0.065BT-*x*BZT]; BNT-BT-BZT (with $0 \leq x \leq 0.50$) were fabricated using the solid-state reaction method. The structure exhibited co-existing rhombohedral and tetragonal phases for all samples. The average grain size decreased from 2.30 μm to 1.25 μm with increasing *x* contents**.** The diffuseness exponent (γ) of the ceramics was between 1.05 and 1.98 indicating that the BNT-BT-BZT solid solutions had diffuse phase transition behavior. The change in the *P-E* loops of the ceramics indicated that the long-range ferroelectric order of the samples was disturbed and turned to the polar nano-regions (PNRs) with increased *x* content. The polarization hysteresis loop transformed from well saturated typical ferroelectric, to pinched, and then to the relaxor state with increased *x* content. The addition of *x* contents significantly enhances the field-induced strain in BNT-BT ceramics. The largest S_{max} of 0.25% corresponded to a high-field effective d_{33}* of 509 pm V^{-1}, which was found in the composition of 0.855BNT-0.065BT-0.080BZT.

Keywords, Phase transition, ferroelectric properties, strain response, BNT-BT-BZT

DP0091

Properties of $NaCu_3Ti_3NbO_{12}$ based-ceramics doped with nanopowders

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Abstract

In this work, the properties of $NaCu_3Ti_3NbO_{12}$ based ceramics preparing by mixed oxide method were studied. The starting material include Na_2CO_3, CuO, TiO_2 and Nb_2O_5 were mixed by ball milled for 24 h with stoichiometry. Calcined at 950 ^oC for 24 h and were doped with (0–2.0 vol%) MgO, Al_2O_3 and ZrO_2 nanopowders. Then, pressed into a disc shape. The green bodies were sintered at 975–1025 ^oC for 10 h. Phase formation by XRD and microstructure by SEM. The body-centered cubic perovskite-related structure of space group Im-3 and small amount of second phase was detected. The normal grain growth is observed and shown rectangular grain shape. Density of the sintered samples was measured by Archimedes's method distilled water as the fluid medium. The relative density values of samples are higher than 86%. Dielectric constant of the samples was examined using an LCR meter and the mechanical properties of samples were investigated by Vickers microhardness tester. The addition of nanopowders less than 2.0 vol%, the mechanical and the dielectric properties are improved.

Keywords: NCTNO ceramics, nanopowders, mechanical property, dielectric property

DP0092

Bioactive behavior and piezoelectric properties of SNCP/xBCZT composites

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Abstract

Bone is a known as piezoelectric material. The piezoelectric properties of bone result from the movement of collagen fibers under a mechanical load. Also, it has been hypothesized that stress-induced potentials in bone affect the activity of osseous formation. In this work, the bioactive ferroelectric 45 wt.% SiO_2, 24.5 wt.% Na_2O, 24.5 wt.% CaO and 6 wt.% P_2O_5/x$Ba_{0.97}Ca_{0.03}Zr_{0.04}Ti_{0.96}O_3$ composites (SNCP/xBCZT composites) with x = 0 20 40 60 80 vol.% have been produced for orthopedic applications. The SNCP/xBCZT composites were fabricated for investigation the relation of piezoelectric properties on apatite formation. Moreover, the dielectric constant was characterized at frequencies ranging from 50 Hz to 2 MHz. The addition of BCZT led to improving piezoelectric properties of SNCP/xBCZT composites. Finally, bioactivity of the SNCP/xBCZT composites were investigated as a function of BCZT contents *in vitro* tests for 7 days using simulated body fluid (SBF) as a media. The bioactivity of the SNCP bioglass was improved with addition of BCZT phase as evident by the formation of bone like apatite layers on the surface of x = 80 vol.% after soaking in SBF with maximum piezoelectric constant (d_{33}) of 31 pC N^{-1}.

Keywords: Bioactive, composite, piezoelectric properties

DP0096

The effect of low current density on the hydrophilicity and surface properties of the anodized films performed by two-step anodization

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Abstract

This work was to improve the hydrophilicity on Ti-6Al-4V surface. The comparative anodized films properties of both untreated Ti-6Al-4V alloys surface and the modified surface performed by two-step anodization at a low current density have been investigated by the contact angle measurement, Field Emission Scanning Electron Microscope (FE-SEM), Atomic Force Microscope (AFM), X-ray photoelectron spectroscopy (XPS). The results show that the surface species, surface morphology, surface roughness and hydrophilicity change with applied current density during anodizing process. Therefore, the anodized films performed by two-step anodization at a low current density can significantly enhance the surface properties of Ti-6Al-4V alloy surface for dental implant applications.

Keywords: Hydrophilicity; low current density; two-step anodization

DP0097

Synthesis and electrochemical properties of porous CNF/Li_xMnSiO_4 for energy storage devices

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Abstract

This work report the synthesis and electrochemical properties of porous carbon nanofibers composited with lithium manganese silicate (porous CNF/Li_xMnSiO_4: x = 1, 2) as electrode material for energy storage devices. The obtained samples were characterized by means of X-ray diffraction (XRD), Transmission electron microscopy (TEM), Scanning electron microscopy (SEM) and Brunauer-Emmett-Teller analyzer (BET). The electrochemical properties were investigated using cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS). The benefits of prepared samples with maximum surface area and high crystallite size leading to enhance the capacity. By varying "x" parameter, the composite of porous CNF to lithium manganese silicate showed two times higher specific capacitance than that of non-composite electrodes. Good cycling stability was also observed with the composite electrode (87–91% retention after 1000 cycles). The fascinating electrochemical properties of porous CNF/Li_xMnSiO_4 composite nanostructure makes it a potential candidate for high performance energy storage devices.

Keywords: $LiMnSiO_4$; $LiMnSiO_4$ composite; Activated carbon composite; Electrochemical properties of lithium transition metal silicate

DP0099

NiO films on ITO substrates etched by HCl acid for electrochromic devices

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Abstract

In this paper, NiO films on etched ITO substrates were prepare by sol-gel spin-coating technique. The ITO substrates were etched by evaporated fume of hydrochloric (HCl) acid. The effect of evaporation time on the structural, optical and electrochromic properties of NiO films were investigated by X-ray diffraction, field emission-scanning electron microscope, UV-VIS spectrophotometer and cyclic voltammetry. XRD patterns of all samples possess the major peaks of (111) (200) and (220) plane orientations corresponding to cubic NiO crystal structure. The XRD results reveal that the crystallite size of NiO films on etched ITO substrates become weakened appearance with evaporation time. FE-SEM images of films show the surface morphology gradual decrease in its grain size and the thickness increase after ITO substrates was etched by HCl acid. The intensity of current on anodic and cathodic peak of NiO film on etched ITO substrates increase moderately, implying increasing amount of ions, protos and electron transfer in electrochemical reaction. Transmittance of NiO film on color state deceases more than 10% after ITO etching. These results reveal that evaporation time has significant influence on the crystallinity and thickness and active surface area of the films. These features imply that coloration efficiency of NiO film can be enhanced by ITO etching process.

Keywords: NiO films, spin-coating method, electrochromic

DP0101

Fabrication of piezoelectric flexible on PVDF/CNTs

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Abstract

Fabrication of piezoelectric module Flexible But still, the properties of the piezoelectric. The study was conducted in the form of composite materials called this material. Poseo Electric Composite The piezoelectric composite consists of a piezoelectric polymer. It is flexible and strong because it combines the physical properties of nanosized materials and polymers. One of the fundamental problems for small-scale applications is the design and selection of effective material structures to convert mechanical energy into electrical energy. In this research, composite dielectric materials were prepared by impregnating carbonnanotubes (MCNTs) into polyvinyl fluoride (PVDF). Composite dielectric composites are fabricated. PVDF / MCNTs are polarized by hot-fixing 135 ℃ Polarizing Piezoelectric Material 1kV and measuring electrical signals by resonant.

Keywords: PVDF NMP CNT composites and actuator

DP0106

Biomass derived carbon materials for electrochemical energy storage

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Abstract

This paper presents water hyacinth and sensitive plant derived carbon as a biomass carbon with utility as electrochemical energy storage. The carbon samples were characterized by X-ray diffraction (XRD) and Scanning electron microscopy (SEM). Electrochemical properties of the carbon materials were investigated by using cyclic voltammetry, galvanostatic charge-discharge, cycling stability and electrochemical impedance spectroscopy. Biomass carbon of water hyacinth and sensitive plant were shown to have specific capacitance of about 31 and 33 F g^{-1}, respectively.

Keyword: Biomass, energy storage, carbon materials, water hyacinth carbon, sensitive plant carbon

DP0107

A facile preparation of cellulose /Zinc oxide nanocomposites for enhancing photocatalytic activity

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Abstract

Applications of cellulose nanocrystals (CNC) as a metal/ metal oxide nanostructure support attracted a lot of attention in the past decade because of their high surface area, reductive surface functional groups and water suspendability. This study reports a low cost, green preparation method for the synthesis of cellulose /zinc oxide (CNC/ZnO) nanocomposites for the methylene blue (MB) photocatalytic degradation. CNC have been derived through the hydrolysis reaction by citric/hydrochloric acid from the pure cellulose isolated having Vietnamese *Nypa fruticans* branches. The influence of the Zn^{2+} ion concentration on the morphology, microstructure, and properties of the CNC/ZnO nanocomposites was investigated by Fourier-transform infrared (FTIR) spectra, X-ray diffraction (XRD) pattern, scanning electron microscopy (SEM) image, and thermogravimetric analysis (TGA). The photocatalytic activity of CNC/ZnO was evaluated via the degradation of methylene blue under ultraviolet irradiation. It was found that, having a suitable concentration of Zn^{2+} ions, CNC/ZnO-1 showed the smallest ZnO nanoparticles with narrow size distribution. In addition, the combination of CNC and ZnO have demonstrated that the thermal stability and photocatalytic activity increase due to the strong their interaction. This study inspired the potential application of this composite for biomedical and photocatalytic fields.

Keywords: Cellulose nanocrystals, nypa fruticans, zinc oxide nanoparticles, nanohybrid, thermal stability, photocatalytic ability

DP0108

Influence of compaction pressure and sintering temperature onto the mechanical properties and tribological property of the brass 8020 product made from the powder metallurgy process

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Abstract

The product made from powder metallurgy process or sintering process has increased volume in Thailand's industrial. The bush and pin products made from brass are very important parts for electric and automotive sections. However, the bush and pin products made from powder process has lower density and mechanical property when comparing with wrought, rolled and casting process. But the most advantage of the product from powder metallurgy process is the lowest cost price when produced in term of mass production. This research focuses on the study the effect of compaction pressure and sintering temperature of the brass product. Prepared the brass powder consist of 80 weight percent of Copper and 20 weight percent of Zinc. Then compact it to be the specimen in the die by varied the pressure of pressing machine. After that put it into the hot oven under controlled the atmosphere by feed N_2, H gas and varied temperature for sintering process. Finally test them to investigating mechanical properties (tension, impact, hardness) and tribological property. The result showed higher compaction pressure gave higher strength and higher wear resistance. For temperature shown only one range temperature supported the optimize properties of higher mechanical property and higher wear resistance.

Keywords: Brass, Bush, compaction, tribology, mechanical property

DP0112

Chitosan extracted from crab shells by reduction of chemical substance technique

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Abstract

Chitosan is a natural biopolymer derived from chitin, which has been extracted from crab and shrimp shells or Insect cuticles. It was utilized for many industries such as pharmaceuticals, cosmetic, food, textile, paper industry and agriculture. This research displays the new route for extraction of chitosan from crab shells. This method is an eco- and environment-friendly process by which reducing chemical substance in the separation process. Firstly, chitin was extracted by deproteinization and demineralization using of pineapple juice and natural acid instead of alkaline solution and inorganic acid, respectively, at ambient temperature. Finally, the deacetylation of chitin to chitosan was performed with strong base at quite high temperature. The structure of extracted chitosan was investigated using Fourier Transform Infrared Spectroscopy (FTIR). The surface area and elemental analysis was observed by scanning electron microscope (SEM) and Energy-dispersive X-ray spectroscopy (EDX), respectively.

Keyword: Chitosan, chitin, crab shells, extraction

DP0113

Fabrication, structural and magnetic properties of Cu-doped BiFeO thin film

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Abstract

The $BiFe_{1-x}Cu_xO_3$ thin films with x = 0.01, 0.02, 0.03, 0.5, 1.0, 2.0 and 3.0 were coated on Pt/Si n-type by spin coating technique. The x-ray pattern purity phase of undoped $BiFeO_3$ thin films and some impurity phase of Cu-doped $BiFeO_3$ thin films were investigated by x-ray diffraction technique. Oxidation states of Bi^{3+}, Fe^{3+} and existence of oxygen vacancy were investigated by x-ray photo electrons spectroscopy. The almost homogeneous thin films surface and films thickness of 200–300 nm were revealed by using scanning electron microscope and cross section technique. The magnetic properties were investigated by vibrating sample magnetometer. Hysteresis loops of M-H of the $BiFe_{1-x}Cu_xO_3$ thin films show improved weak ferromagnetic with increase of Cu content. Susceptibility dependence temperature of $BiFe_{1-x}Cu_xO_3$ thin films exhibits antiferromagnetic behavior with neel temperature about 60–75 K for Cu-doping samples at x = 0.5–2.0. Moreover, magnetic coercivity increases for H_c ~100–600 Oe with increasing of Cu content at x = 0.0–2.0.

Keywords: BiFe1–xCuxO3 thin films, spin coating technique, Antiferromagnetic, Thin films

DP0116

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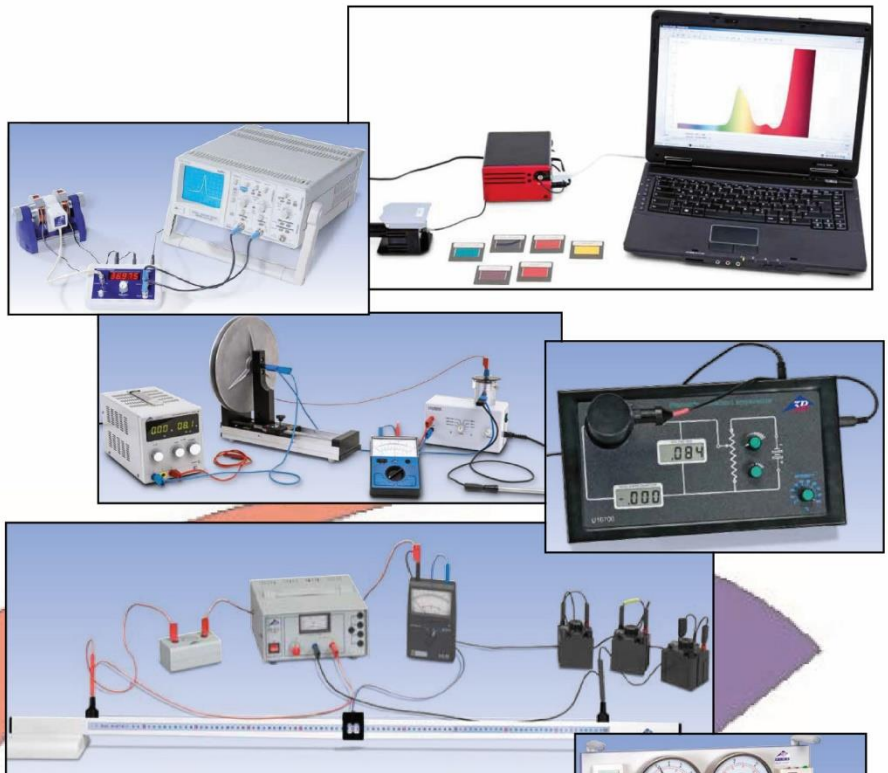

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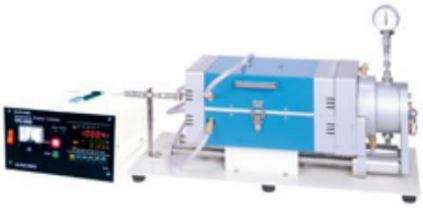

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