3rd INTERNATIONAL CONFERENCE ON ADVANCED MATERIALS AND PROCESS ENGINEERING (AMPE)

11 & 12 DECEMBER 2019

ORGANIZED BY

DEPARTMENT OF CHEMICAL ENGINEERING AND
DEPARTMENT OF POLYMER & PETROCHEMICAL ENGINEERING
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3rd International Conference on Advanced Materials & Process Engineering

CONFERENCE PROGRAM AMPE– 2019

Day – 1: 11th December, 2019

INAUGURAL SESSION

08:30 – 09:45 hours	Registrations
10:00 – 10:05 hours	Recitation of Holy Quran
10:05 – 10:10 hours	National Anthem
10:10 – 10:20 hours	Welcome address by The Vice Chancellor
10:20 – 10:50 hours	Keynote Speech (Prof. Dr. Fawad Inam)
10:50 – 11:00 hours	Inaugural address by Chief Guest (Governor Sindh: Mr. Imran Ismail)
11:00 – 11:10 hours	Address by Guest of Honor (Pro- Chancellor of Universities: Mr. Nisar Ahmed Khoro)
11:10 – 11:15 hours	Vote of Thanks by the Conference Secretary
11:15 – 11:45 hours	Refreshment

Technical Session –I

11:45 – 13:05 hours **Advanced Materials**
03 presentations

Chair :Prof. Dr. Fawad Inam Co-Chair : Dr.Zhilun Lu

"Bismuth Ferrite-Based Lead-Free Ceramics and Multilayers with Large Strain and Energy Density" (KEYNOTE SPEECH)

Dawei Wang

Department of Materials Science and Engineering, University of Sheffield, Sheffield S1 3JD, UK.

"Opportunities and Challenges in Biomass Gasification; A Pakistani Perspective" (PLENARY SPEAKER)

Naveed Ramzan, Anem Saeed

Department of Chemical Engineering, University of Engineering and Technology GT Road

Lahore Pakistan.

"Surface Mechanical Response of Polymers: Nanoindentation & Scratch Hardness" (PLENARY SPEAKER)
Tanveer Iqbal
Chemical, Polymer & Composite Engineering Department, University of Engineering & Technology, Lahore, Pakistan

13:05 – 14:00 hours Lunch and Prayers break

Technical Session –II

14:00 – 16:00 hours **Chemical Processes**
05 presentations (20 minutes each)

Chair :Prof. Dr. Naveed Ramzan Co-Chair : Dr.Tanveer Iqbal

"Enhancing Piezoelectricity through Texture Engineering" (PLENARY SPEAKER)
Ali Hussain[1], Myong Ho Kim[2]
[1]Department of Materials Science & Engineering, Institute of Space Technology, Islamabad 44000, Pakistan
[2] School of Materials Science & Engineering, Changwon National University, Gyeongnam 51140, Republic of Korea.

"Pyrolysis of high-ash sewage sludge (HASS)" (KEYNOTE SPEECH)
Salman Raza Naqvi
School of Chemical & Materials Engineering, National University of Sciences & Technology Islamabad, Pakistan.

"Prepartion Of Smart Glass Panel Via Pips Method"
Mujtaba Ellahi*[1], Jan Muhammad[2], M.Furqan Ali[3], and Kashif Hussain Mangi[4]
[1*] Advanced Polymer Science Laboratory, Department of Chemistry, Faculty of Arts & Basic Sciences,
Balochistan University of Information Technology, Engineering and Management Sciences (BUITEMS). Quetta 87100 Pakistan.
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[3]State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, Beijing 100029, P.R.China
[4]Studio 110, John Pershing Residence, 60 rue Michel Ange, Saint Nazaire, and University of Nantes, France.

"Synthesis Of Metal Sulfides (Cu And Ni Sulfide) For Hydrogen Evolution Reaction (Her) And Carbon Dioxide Reduction (CO2R)"
F.A. Butt[1,*] ,M.S. Hanif[1], M.S.A. Asgher[1], D. Majeed[1]
[1]Materials Engineering Department, NED University of Engineering &

Technology, Karachi, Pakistan

"Effect Of Cigarette Butts Extract As Corrosive Inhibiting Agent In AISI 4140"
Hira Younus[1,*], Muhammad Sohail Hanif [2], Ali Dad Chandio [3]
[1] Materials Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan
[2] Materials Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan
[3] Metallurgy Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan.

16:00 – 16:30 hours **Refreshments**

Day – 2: 12th December, 2019

Technical Session –III

09:00 – 10:40 hours **Nanocomposite Materials**
04 presentations

Chair : Dr. Dawei Wang Co-Chair : Dr.Hameed Ullah

"Thermoelectric Oxides" (KEYNOTE SPEAKER)
Zhilun Lu
Henry Royce Institute at Sheffield. United Kingdom

"Fluoride Mediated Cubic Self Assemblies Of Zinc-Tin Oxide Nanoparticles – Role Of Structure Directing Agents" (PLENARY SPEAKER)
Hameed Ullah[1], Abdul Khaliq
Department of Chemistry, Islamia College Peshawar, Peshawar, Pakistan

"Emerging Challenges In Membrane Technology" (PLENARY SPEAKER)
Mohammad Younas
Department of Chemical Engineering, University of Engineering and Technology, Peshawar 25120, Pakistan.

"Polyvinyl Alcohol And Nanoclay Based Barrier Composite For Packaging Applications"
I.A. Channa[1,2*], **A.D. Chandio[1],** A.A. Shah[1]
[1]Metallurgical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

[2]Friedrich Alexander University of Erlangen, Nuremberg, Germany

10:40 – 11:30 hours Tea Break & Poster Presentation

Technical Session –IV

11:30 – 13:10 hours **Energy & Environment**
04 presentations

Chair : Dr. Dawei Wang Co-Chair : Dr.Saud Hashmi

"Synthesis And Charaterisation Of Silica Nanoparticles For Energy Applications"
M.S.A. Asghar[1], F.A. Butt[1,*] , D. Majeed[1], M.S. Hanif[1]
[1]Materials Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

"Post-combustion CO2 capture through sweep gas with composite hollow fiber membrane in membrane contactor"
Tariq Tahir*, Imran Khan Swati, Amir Muhammad, Mohammad Younas.
Department of Chemical Engineering, University of Engineering and Technology, Peshawar, Pakistan

"Temperature dependent piezoelectric properties of lead-free(1-x) K0.6Na0.4NbO3–xBiFeO3 ceramics"
Amir Khesro
Abdul Wali Khan University, Mardan, KPK

"Solar Feasibility Analysis of a Technical Institute and PV Materials and Industry Status In Pakistan"
H.M.S. Adnan Ali[1*], Muhammad Hammaduddin[1], M.S. Saad[2,] Hafiza Haziqah Hameed[2], Pirah Sikandar[2], Iqra Shaheen[2]
Faculty[1]/Student[2] Electrical Engineering Department, NED University of Engineering & Technology, Karachi, Pakistan

13:10 – 14:00 **Lunch & Prayers**

Technical Session –V

14:00 – 15:00

Chemical Processes – II
03 presentations

Chair : Prof. Dr. Muhammad Younas Co-Chair : Dr.Faizan Raza

"Oxidative desulfurization of Petrochemical waste water by Ozonation method"
S. F. Hasany[1], **M. Ammar[2]**, G. Hussain[3], Wafa. A[4,] A. Qureshi[5]
[1,2,3,5]NED UET, Karachi Pakistan, [4] *University of Technology, Baghdad, Iraq.*

"Synthesis and characterization of Hydroxyapatite and Bioglass composite using Spark Plasma Sintering for improved biological performance"
M. Rizwan[a], M. Hamdi[b] and W. J. Basirun[c]

[a] Department of Metallurgical Engineering, Faculty of Chemical and Process Engineering, NED University of Engineering and technology, 75270, Karachi, Pakistan.
[b] Department of Mechanical Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia.
[c] Department of Chemistry, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia.

"Production of Raw Crude Oil from Microlage by using Photobioreactor
Tuba Siraj"
Department of Chemical Engineering, Ned University of Engineering and Technology

"Estimation of flame length in a normal shaft kiln"
Salman Ali Khan[1], **Ibtihaj Khurram Faridi[2]**
[1]NED University of Engineering and Technology, Karachi

CONCLUDING SESSION	
15:00 – 15:10 hours	Concluding Remarks Pro-Vice Chancellor: Dr. Muhammad Tufail
15:10 – 15:20 hours	Address by the Chief Guest Provincial Minister: Mr. Imtiaz Ahmed Shaikh
15:20 – 15:40 hours	Address by Guest of Honor Adviser to Chief Minister of Sindh: Mr. Murtaza Wahab
15:40 – 15:45 hours	Vote of Thanks by Prof. Dr. Kausar Ali Syed
15:45 – 16:30 hours	Refreshments

Bismuth Ferrite-Based Lead-Free Ceramics and Multilayers with Large Strain and Energy Density

Dawei Wang

Department of Materials Science and Engineering, University of Sheffield, Sheffield S1 3JD, UK
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Abstract: Lead-free ceramics with high recoverable energy density (W_{rec}) and large electromechanical strains (S_{max}) are attractive for advanced pulsed power capacitors and actuators to enable greater miniaturization and integration. In our recent work, dense bismuth ferrite (BF)-based, lead-free relaxor ceramics and multilayers were fabricated. Compositional impact on the structure-property relationships, in particular on the electromechanical strain and energy storage characteristics were evaluated. Large S_{max} of > 0.4% with effective d_{33}^* of >400 pm/V was observed, suggesting that this family of ceramics have potential for high strain actuators. Furthermore, due to the enhanced breakdown field strength (BDS) and large maximum polarization (P_{max}), high W_{rec} of > 2 J/cm^3 were achieved. Multilayers of this composition possessed both high W_{rec} of 10.5 J/cm^3 and η of 87% and were stable up to 150 °C, which are therefore considered promising candidates for lead-free energy storage applications.

Keywords: energy storage, bismuth ferrite, lead-free ceramics, piezoelectrics, capacitors, actuators

Next generation Carbyne reinforced carbon nanotube – epoxy nanocomposites

Chinyere Okolo[1], Rafaila Rafique[2], Sadia Sagar Iqbal[3], Iftikhar Ahmad[4], Mohd Shahneel Saharuddin[5], Badekai Ramachandra Bhat[6] and Fawad Inam[7*]

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[5] Universiti Kuala Lumpur, Malaysia Italy Design Institute (UniKL MIDI), Kuala Lumpur, Malaysia
[6] National Institute of Technology Karnataka, Department of Chemistry, Mangaluru, India
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Abstract: Carbyne, a next generation allotropic form of carbon, is a long single chain of carbon atoms joined via double and triple covalent bonds. A mass production strategy for manufacturing stable and nearly infinite length of carbon chains (carbyne) inside carbon nanotubes was recently published. This work reports on the very first successful attempts to produce stable carbine enhanced carbon nanotube – epoxy nanocomposites. Existence of carbyne encapsulated in carbon nanotubes was confirmed via near field Raman spectroscopy. Good quality of dispersion was observed in epoxy matrix as confirmed via field emission scanning electron microscopy. A critical comparison between epoxy nanocomposites utilising carbyne enhanced and non-carbyne enhanced is presented. A review of the improved mechanical properties (i.e. strength, modulus and toughness) and number of potential applications are highlighted in this work. In general, carbyne significantly improved the mechanical properties of the carbon nanotube – epoxy nanocomposites and demonstrated a great potential for substitution in advanced materials and products, which is showcased in this work.

Thermoelectric Oxides

Dr. Zhilun Lu

Henry Royce Institute at Sheffield
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Abstract: Most state-of-the-art thermoelectrics with high Figures of Merit (ZT) values are composed of toxic, naturally rare and heavy metal elements. As a result, further work is required to develop low-cost, stable materials based on oxides. Excellent properties for p-type oxides have already been reported. However, n-type oxides with equivalent ZT values have yet to be discovered to date. SrTiO3-based systems have attracted considerable attention due to their high thermoelectric properties by so-called donor-doping with higher valence ions on the A- or B-site, especially lanthanum-doped SrTiO3 (LST). In this talk, I will introduce a successful strategy by creating A- site and O deficiency in the perovskite structure to improve the thermoelectric performance by reducing thermal conductivity and increasing the electrical conductivity, thereby optimizing ZT.

Enhancing Piezoelectricity through Texture Engineering

Ali Hussain[1'*] and Myong Ho Kim[2]

[1] Department of Materials Science & Engineering, Institute of Space Technology, Islamabad 44000, Pakistan
[2] School of Materials Science & Engineering, Changwon National University, Gyeongnam 51140, Republic of Korea

Abstract: Lead-free sodium excess Ta-modified (K0.470Na0.545)(Nb0.55Ta0.45)O3 textured piezoelectric ceramics were developed by reactive templated grain growth (RTGG) process employing NaNbO3 (NN) template. The plate-like NN templates were first produced from Bi2.5Na3.5Nb5O18 (BNN) precursor via a topochemical microcrystal conversion (TMC) method. Utilizing 5 wt% of NN templates, textured KNNT ceramics were developed, and their structural, microstructural, dielectric, electromechanical properties were measured and compared with their non-textured KNNT counterpart prepared by a conventional method. The textured KNNT ceramics exhibited a high grain orientation and improved dielectric constant. Likewise, the piezoelectric response of the textured KNNT ceramics were enhanced, showing a high piezoelectric coupling coefficient kp = 0.60 along with enhanced static piezoelectric coefficient d33 = 390 and dynamic piezoelectric coefficient d * 33 = 460 pC/N.

FLUORIDE MEDIATED CUBIC SELF ASSEMBLIES OF ZINC-TIN OXIDE NANOPARTICLES – ROLE OF STRUCTURE DIRECTING AGENTS

Hameed Ullah[1], Abdul Khaliq
[1] Department of Chemistry, Islamia College Peshawar, Peshawar, Pakistan

Abstract: Self assembling of nanoparticles (NPs) into three dimensional (3D) superlattices is of particular interests from technological perspectives. Mimicking the natural and biological systems the 3D superlattices of NPs possess tunable properties, and thus have many technological applications [1, 2]. Hybrid zinc-tin oxide NPs cubic self assemblies are fabricated exploiting fluoride (F-) ions as structure directing agents [3]. In a typical solution process, zinc and tin salts were mixed in a 1:1 molar ratio and oxidized using NaOH. To control the self assembling process, F- ions were added in appropriate concentrations. The resulting hybrid powder was heated at 600°C for 4 hours to expel the adsorbed F- ions. Morphological investigations (SEM and TEM) revealed that the zinc-tin oxide hybrid NPs self assembled into cubic shaped super structures (Fig. 1). Furthermore, the self assembling is controlled by the F- ions, and is evident from the fact that the cubic structure formation enhances with increasing concentration of F- ions. Also, the sample without F- ions does not possess cubic self assembly. Crystal structure study (XRD) revealed the formation of zinc-tin oxide nanocomposites in all the samples. The structural properties are further elaborated using FTIR and Raman spectroscopy. The opto-electronic properties of hybrid NPs are established using diffused reflectance

spectroscopy (DRS), and the photocatalytic performance is studied following the decoloration of selected dye under UV-vis spectrophotometer.

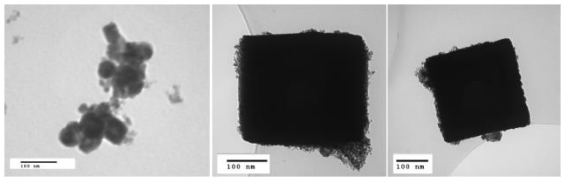

Fig. 1 Cubic superlattices of zinc-tin oxide hybrid NPs. Increasing F^- ion concentration from left to right

References:

1. E. V. Shevchenko, D. V. Talapin, N. A. Kotov, S. O'Brien and C. B. Murray, *Nature*, **439**, 55 (2006).
2. J. J. Urban, D. V. Talapin, E. V. Shevchenko, C. R. Kagan and C. B. Murray, *Nat. Mater*, **6**, 115 (2007).
3. M. Kalsin, M. Fialkowski, M. Paszewski, S. K. Smoukov, K. J. M. Bishop and B. A. Grzybowski, *Science*, **312**, 420 (2006).

Opportunities and Challenges in Biomass Gasification; A Pakistani Perspective

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Abstract: The high output of waste material, which is increasing during recent years and limitation of the existing means of its disposal has compelled the researchers to find alternative routes for its management. Depletion of fossil fuels and growing awareness of environmental consequences resulting from global warming has led to the importance of waste for energy production. Pakistan is rich in the production of biomass because of the appropriate growing environment and fertile land. Being an agricultural country, nearly 62% of its population resides in rural areas and is directly or indirectly linked with agriculture for their livelihood. Pakistan is the 10th largest rice producing country and approximately 100 million tons of RH is obtained annually. Considering all agricultural waste, Pakistan has technical potential of 2492 MW power generation.

Biomass is a lignocellulosic source and can be used in power generation, however, some of its inherent characteristics like high moisture content and slagging makes it an inefficient fuel due to which larger amounts are needed than the fossil fuel to get the same amount of energy. High moisture content in the biomass is due to its hydrophilic nature. It decreases the process efficiency and increases the cost. It also leads to low energy density, natural decomposition (fungal attack and biodegradation) and uncertainty in physical, chemical and microbiological properties. The slagging nature is caused by the mineral matter present in the biomass in the form of alkali and alkaline earth metals (AAEM). The melting points of AAEM are lower than the usual combustion temperatures. At their melting points, the AAEM capture the particles, deposit

on the heat exchanger surfaces and make an insulative layer (slag) which reduces the heat transfer.

The agricultural residue can be converted into energy by application of thermo-chemical process such as combustion, pyrolysis/gasification and liquefaction. Pyrolysis/gasification converts solid fuels into combustible gases known as syngas. In this talk, potential of both solid and liquid waste in energy production as well as pyrolysis/gasification technology, its basic principles and some of the factors that affect pyrolysis products will be presented.

Gasification/Pyrolysis has been employed as a disposal method for solid waste like biomass, municipal waste, tyre waste, and liquid waste like used cooking oil, engine oil etc. These various types of waste are pyrolysed under certain conditions and resulted in the generation of fuels. A critical comparison of pyrolysis parameters followed by resulting product yields and compositions will also be presented for both solid and liquid waste pyrolysis along with the barriers and challenges in commercialization of this technology in Pakistan perspective. It is investigated that these wastes can produce bioenergy and green chemicals. The recovered syngas from waste can be utilized in various applications such as power generation, petro-chemicals, liquid fuel synthesis etc. The recovery of valuable gases from pyrolysis proves to be a better mean for energy security over traditional destructive approaches.

Pyrolysis of high-ash sewage sludge (HASS)

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Abstract: Pyrolysis of high-ash sewage sludge (HASS) is a considered as an effective method and a promising way for energy production from solid waste of wastewater treatment facilities. The main purpose of this work is to build knowledge on pyrolysis mechanisms, kinetics, thermos-gravimetric analysis of high-ash (44.6%) sewage sludge using model-free methods & results validation with artificial neural network (ANN). TG-DTG curves at 5,10 and 20 °C/min showed the pyrolysis zone was divided into three zone. In kinetics, E values of models ranges are; Friedman (10.6–306.2 kJ/mol), FWO (45.6–231.7 kJ/mol), KAS (41.4–232.1 kJ/mol) and Popescu (44.1–241.1 kJ/mol) respectively. ΔH and ΔG values predicted by OFW, KAS and Popescu method are in good agreement and ranged from (41–236 kJ/mol) and 53–304 kJ/mol, respectively. Negative value of ΔS showed the non-spontaneity of the process. An artificial neural network (ANN) model of 2 * 5 * 1 architecture was employed to predict the thermal decomposition of high-ash sewage sludge, showed a good agreement between the experimental values and predicted values (R2 □ 0.999) are much closer to 1. Overall, the study reflected the significance of ANN model that could be used as an effective fit model to the thermogravimetric experimental data.

Surface Mechanical Response of Polymers: Nanoindentation & Scratch Hardness

Dr. Tanveer Iqbal

Chemical, Polymer & Composite Engineering Department, University of Engineering & Technology, Lahore, Pakistan

Abstract: Effective selection and design improvements of materials in surface engineering and tribological applications require knowledge of their near-to-surface mechanical properties. A better understanding and control of the surface mechanical properties of polymers is required for their optimal use as engineering materials. This is particularly important when these materials are used to improve the contact mechanical properties, where polymers are adopted in optical, coatings and plastic engineering applications for consumer products, or tribological performance of bearings. Therefore, this experimental study seeks to elucidate an understanding of the response of semicrystalline polymers in single point contacts. The experimental study is based upon the indentation and scratching techniques for surface mechanical property characterization. Indentation is a relatively simple and virtually non-destructive means of assessing mechanical properties of materials by an indenter, inducing a localized deformation into a solid surface. The load-displacement curves, the hardness, the elastic modulus, the plasticity index and the creep response data and associated analysis for polymeric surfaces are presented as a function of the contact displacement. Scratching of an asperity contact on the material surface is one of the most significant stresses from the widest range of chemical and mechanical stresses that a solid polymeric product might experience in its life. The scratching process is a well-known concept and is generally defined as a kind of surface abrasion, provoked by the relative friction of two material objects where one is significantly sharper and harder than the other. Perceiving, or

assessment, of a scratch is usually correlated to the visual detection by the observer as these may be of any size and length. Scratches were produced on polymeric surfaces using rigid cones of different cone included angles and under different normal loads. The prevailing deformation mechanism and geometry of damage on the scratched polymeric surfaces were assessed using scanning electron microscope (SEM) and an optical profilometer. Deformation maps of the polymeric surfaces have been constructed under various contact conditions using the scratching technique. These maps provide a convenient means to report the deformation behaviour of the polymeric surfaces when the imposed scratch conditions are changed. The penetration depth of the imposed scratch in the material has a significant bearing on the resultant deformation, in addition to the previously reported effects of the indenter velocity, normal loads and attack angle.

Temperature dependent piezoelectric properties of lead-free(1-x) $K_{0.6}Na_{0.4}NbO_3$– x$BiFeO_3$ ceramics

Dr Amir Khesro

Abdul Wali Khan University, Mardan, KPK

Abstract: "Small additions of $BiFeO_3$ broadens and lowers the cubic to tetragonal transition (T_C). The tetragonal to orthorhombic phase transition (T_{O-T}) is shifted towards room temperature. Ceramics with $x = 0.01$ shows good piezoelectric properties with $d_{33} = 182$ pC/N and $d_{33}^* = 250$ pm/V and electromechanical coupling coefficient, $k_p = 50$ %. The piezoelectric properties are stable with temperature in the orthorhombic phase field. Properties monotonically degrades in the tetragonal phase field as T_C is approached"

Oxidative desulfurization of Petrochemical waste water by Ozonation method

S. F. Hasany[1], M. Ammar[2], G. Hussain[3], Wafa. A[4,] A. Qureshi[5]

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Corresponding author: hasany@neduet.edu.pk

Abstract: Petrochemical water effluents possess significant amount of sulfides, which are harmful to the environment surrounding the refineries. In the presented study, ozone has been employed as an oxidant in comparison to other common oxidizing agents such as chlorine, hypochlorous acid, potassium permanganate, and hydrogen peroxide. For the purpose, petrochemical wastewater sample was collected from south east coast petrochemical industry, and ozone was applied to oxidize both raw and sulfide added wastewater. The sulfide removal efficiencies at initial sulfide concentration of 40 mg/L, 30 mg/L and 20 mg/L after ozonation were observed 95.5%, 94% and 91%, respectively.

Key words: desulfurization; ozone; sulfides; Petrochemical water effluents

PREPARTION OF SMART GLASS PANEL VIA PIPS Method

Mujtaba Ellahi[*1], Jan Muhammad[2], M.Furqan Ali[3], and Kashif Hussain Mangi[4]

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Abstract: In this work, we reported the preparation and characterization of smart glass panel thin films using with epoxy resin monomers/ hardener / Nematic Liquid Crystal (NLCs) system. In this study, we have been arranged polymerization induced phase separation (PIPS) heat curing method to use the Tri ethylene tetramine (TETA) hardener and Neopentyl glycol diglycidyl ether (NGDE) epoxy resin of thin smart films by curing time 5 hour and at 75°C. The prepared smart glass panel films were characterized using liquid crystal device (LCD) parameters tester, scanning electron microscopy (SEM), and Abbe Refractometer. The liquid crystal device technique confirms the interaction of NGDE monomer and TETA hardener. The microstructural and dispersion of polymer matrix/domain size of LC were confirmed by SEM. The detailed study of Abbe Refractometer shows the smaller the mismatching degree of the refractive indices of the LC domain size and the polymer matrix. The goal of this research work to introduce the NGDE / TETA / NLCs thin films system in smart films glass technology. These smart films technology studies will elucidate new insights in commercial applications of intelligent PDLC films, photoelectrical applications, such as switchable windows, micro lenses, reflective displays, multi-color displays, and biosensors.

Keywords: smart glass, hardener, Nematic Liquid Crystal, polymer matrix.

SOLAR FEASIBILITY ANALYSIS OFA TECHNICAL INSTITUTE AND PV MATERIALS AND INDUSTRY STATUS IN PAKISTAN

H.M.S. Adnan Ali[1]* ,Muhammad Hammaduddin[1], M.S. Saad[2], Hafiza Haziqah Hameed[2], Pirah Sikandar[2], Iqra Shaheen[2]

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Abstract: This paper gives the feasibility analysis of solar energy supply for a part of the electrical load of one substation of NED University of Engineering and Technology using the software PV Syst V6.64.The assessment criteria for this feasibility analysis are rate of investment, net present cost, renewable factor and payback time. The result are promising and have far reaching implications of reducing energy crisis of Pakistan, extending the result to other institutes and buildings and reducing CO2 emissions in the process for a sustainable environment. Based on the simulation results one roof top was selected and solar system of 51.28KW was designed for it. Solar panel selected is JAP6 72/320/3BB and 162 panels each of 320 W along with 3 phase inverter SMA Core1, 50KW gave 51.28KW power for one substation of the institute. The overall system cost came out to be 3,714,880 PKR which will pay back within 1 year and 3 months as shown in ROI calculations. Along with this the current trend of materials have been reviewed from efficiency and cost point of view and local market of solar cells have been surveyed with respect to PV panels in Pakistan. The challenges and future recommendations for technology implementation are explored in Pakistan environment.

Keywords: Solar Energy; NED University; PV materials, Energy feasibility

EMERGING CHALLENGES IN MEMBRANE TECHNOLOGY

Dr. Mohammad YOUNAS (Professor)

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Abstract: Membrane technology was in its infancy about 50 years ago. In 2010 the global desalination market reached US$ 12.5 billion which is expected to touch US$ 52.4 billion by 2020 with over 320 % increases. The reverse osmosis witnessed the largest growth. In future, membrane technology is focusing the water scarcity, energy crisis and food security. As limited resources, energy and water are closely inter-related. 7 % of all energy consumed globally is used to produce water and, at the same time, 50 % of the water supply is used to generate power, and both might increase in the future. Over 1 billion people, many in developing countries, currently lack access to clean drinking water and 2.6 billion suffer inadequate sanitation. By 2050, it is estimated that half of world's population will face water scarcity. Likewise, food security is also threatening as world's population is expected to increase by 40 to 50 % over the next 50 years. Therefore, the engineers and membranologists are seeking new ways for the efficient and sustainable production of water, using less energy [1,2].

The most viable, emerging and sustainable alternative is to use membrane technology to explore the untouched resources and to expedite the process efficiency. To address the issue of water scarcity for sustainable development, membrane technology will have the substantial role in water cleansing. The advances in membrane technology will involve development of improved membranes and processes and strategies to optimize performance [3].

The conventional membrane processes include microfiltration, ultrafiltration, nano filtration and

reverse osmosis for wastewater treatment. Emerging membrane processes such as membrane bioreactor (MBR), membrane distillation (MD), osmotic evaporation (OE) and forward osmosis (FO) inherit potential advantages for reducing overall energy requirements and are in developing stage. Membrane bioreactor (MBR) is an emerging single step process for biological treatment. Nevertheless, membrane materials, modules, and systems with low membrane-fouling rate are still challenging. MD has also been considered in food industry like for the concentration of fruit juices. Nevertheless, synthesis of an ideal membrane with relative high flux to RO membrane is still the challenge for FO. Membrane distillation offers several benefits over state of the art thermal based processes which include, theoretically complete rejection of all non-volatile components, potential to use the waste heat or energy, operable at the concentration ranges which are beyond the approach of conventional pressure driven based processes, safer an clean operations. The processes have the challenges to treat the effluents to recover the harmful/useful components from the effluents streams and thus agree well with the objectives of sustainable development. Forward osmosis on the other hand, will cover the desalination of seawater and brackish water and reuse of municipal wastewaters [2,3]. R&D needs will be outlined targeted at the improved understanding of the effect of main operating and design parameters on process performances. Thus importance of advanced CFD is also the area of interest for the engineers and membranologists. The future outlook of membrane technology is also linked to hybrid processes. Emerging membrane technologies can be expected to contribute to the development of innovative hybrid processes meeting yet unresolved challenges.

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NUMERICAL MODELLING AND SIMULATION OF HOLLOW FIBER MEMBRANE CONTACTOR FOR POST-COMBUSTION CO_2 CAPTURE WITH NANO FLUIDS

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Abstract: This study presents a 2D numerical model for post-combustion CO2 capture in hollow fibre membrane contactor (HFMC) using Nanofluids as absorbent. A minimodule of hollow fiber membrane contactor made of polyvinyldiene difluoride (PVDF), hydrophobic membrane was taken for mass transfer modelling and numerical simulation. A gaseous mixture (CO2 + N2) flows in the shell side while nanofluid (carbon nanotube+H2O) as absorbent flows counter currently in the tube side of membrane contactor. A mathematical model based on momentum and mass transfer of selective specie (CO2) was developed and simulated. The effect of nanoparticles on absorption is investigated by studying two different mechanisms i-e grazing effect and Brownian motion. Grazing effect has been modelled by creating a physics interface and simulated by using COMSOL Multiphysics. The simulation results from the model were compared with the experimental data taken from literature to verify the validity and accuracy of the developed model. The simulation results show that, using nanoparticles as absorbent increases the mass transfer rate and grazing effect plays an important role in the gas adsorption on the nanoparticles at the gas liquid interface.

Keywords: Membrane Contactors; Nano fluids; CO_2 capture; Hydrophobic membrane

Synthesis of Metal Sulfides (Cu and Ni Sulfide) For Hydrogen Evolution Reaction (HER) and Carbon Dioxide Reduction (CO2R)

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Abstract: In the last couple of decades, it has been established that platinum shows excellent catalytic properties specially in case of hydrogen production but it is expansive and researchers have also found cheap alternative of Pt which is MoS. In this study, we have demonstrated the development of copper and nickel sulphides from traditional routes i.e. thermal and electrolytic methods. The synthesised surfaces are characterised by using XRD and SEM. XRD pattern confirms the formation of both compounds. Surface morphology studies using SEM, provides the detailed structural difference of surface structure obtained by different techniques in both CuS and NiS.

Keywords: CuS; NiS; HER, catalysis; electrochemistry; plasma

Synthesis and Charaterisation of Silica Nanoparticles for Energy Applications

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Abstract: We have successfully developed silica nanoparticles using sol gel method by using sodium silicate and hydrochloric acid. The particle size varies between 50-150nm. The synthesized particles are characterized by using SEM and XRD. We observed that size of the nanoparticles is a function of closely controlled synthesizing parameters such as but not limited to concentration of reacting species, stirring rate and temperature of the reaction vessel. We found that, for optimal size and shape of nanoparticles; the HCl concentration should be 3%, stirring rate 250rpm and temperature 60^{o}C.

Keywords: silica; nanoparticles; sol-gel; SEM; XRD

Estimation of Flame Length in a Normal Shaft Kiln

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Abstract: The effects of various parameters on flame length in a lime shaft kiln were numerically investigated. A shaft kiln with a diameter of D = 3m and a length of L = 15m was used. The numerical model comprises a set of simple governing equations based on mass and energy balance. The effect on the flame length was estimated for fuel velocity (2, 4, 6, 8 m/sec), burner depth (0.1, 0.2, 0.3m) and particle diameter (0.2, 0.15, 0.1, 0.05 m). The results are presented by plotting mole fraction of fuel gas (CH4). For any kiln design an insight into these effects on flame length is crucial.

Polyvinyl Alcohol and Nanoclay Based Barrier Composite for Packaging Applications

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Abstract: Most of the organic matter, especially food contaminate and lose its quality when exposed to environmental gases i.e. moisture. Thus, in order to maintain the quality of organic materials a good quality covering is essential. In this work, we have developed nano-composites of polyvinyl alcohol with incorporation of nano-clay with easy processing and environmental friendly method. The developed composites exhibited transparency of over 90% in the white light region and moisture permeability down to 2.8 x 10-2 g.cm/m2.day at 40oC and 85% relative humidity (RH), which is in close accordance with Bharadwaj's theoretical permeability model. The resulting composite also exhibited excellent flexibility and showed no loss of barrier quality even after 10,000 bending cycles.

Keywords: Nanocomposite, packaging materials, moisture barrier, flexibility, transparency

Post-combustion CO_2 capture through sweep gas with composite hollow fiber membrane in membrane contactor

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Abstract: Most of the power plants and manufacturing industries are using coal to generate electricity. The abundant use of coal is the main anthropogenic source of high content of CO2 in atmosphere leading towards global warming. Therefore, CO2 capture from flue gases has become of great interest to the scientist. Sweep gas capture of CO2 with selective/non-selective membranes under low/atmospheric pressure is one of the emerging techniques used for post-combustion process.

Membrane contactor devices offer large surface area to make the process more efficient and effective. In this work, a composite hollow fiber membrane was prepared from Polyvinylidene difluoride (PVDF) coated with dense layer of Polydimethylsiloxane (PDMS) and Silica Nano particles (SiO2). PDMS and SiO2 were used in different weight percent, ranging from 2 wt % to 10 wt %. The synthesized membrane modules were tested and analyzed for membrane permeability and selectivity. It was found that the membrane has the selectivity of 1.9 and permeability 10.6×10^3 barrer for mixture of gases.

Keywords: Composite membrane, sweep gas, CO2 capture, selectivity and permeability, hydrophobic membrane.

Effect of Cigarette Butts Extract as Corrosive Inhibiting Agent in AISI 4140

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Abstract: It is esteemed that cigarette butt contain metals and metalloid which provide passivity toward corrosion. The present study project is to recycle cigarette butts, taking advantage of this common waste as a corrosion inhibitor on AISI 4140 with 10% HCl. The effects of different concentrations on the efficiency of the cigarette butts are also investigated. The chemical compounds present in the crude extracts analyzed using atomic absorption spectroscopy. The inhibition behavior of cigarette butt extract on AISI 4140 was determined in a 10 % HCl solution, via potentiodynamics polarization technique. Surface analysis was done by stereo lieca microscope.

Keywords: AISI 4140, cigarette butt inhibitor, corrosion environment, potentiodynamic polarization.

Production of Raw Crude Oil from Microlage by Using Photobioreactor

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Abstract: The most promising alternative source for the fossil fuel is biodiesel which can be obtained from a number of plant's raw material but microalgae has proved to be the best choice in this regard due to biodiversity, noncompetitive with food crops and can be completely utilized for the biofuel production. The closed photo bioreactor is selected for the growth of microalgae among different modes of growth due to high biomass density with minimum contamination and growth rate can be increased by adding nutrients. The proposed tubular bioreactor use sunlight for photosynthesis and $co_2$from the atmosphere by using transparent PVC pipes so that fabrication and handling is safe. As the growth of algal culture is batch process so the tubes are designed in a way that each of the tube can be separately taken out from the reactor for the removal of biomass and for the cleaning purposes. A number of similar batch bioreactors can be made for the continuous supply of biomass for the extraction of algal crude and its transesterification process into biodiesel. The design included almost every aspect for the maximum growth of microalgae with less energy consumption to make this a worthy and promising option for alternative fuel.

Keywords: microalgae, tubular photobioreactor, growth, energy, efficient.

Synthesis and characterization of Hydroxyapatite and Bioglass composite using Spark Plasma Sintering for improved biological performance

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Abstract: The biomaterials employed most commonly for dental and orthopaedic surgeries belong to Calcium phosphate (CaP) family, such as β-tricalcium phosphate (TCP) and hydroxyapatite (HA). Despite tremendous biocompatibility of HA, its high resemblance with the mineralized component of the natural bones affects the bio-dissolution rate in the body. Furthermore, numerous *in vivo* studies have reported the inadequate formation of osseous tissues. Composite scaffolds containing BG powder (0 to 30 wt %) were prepared using Spark Plasma Sintering (SPS) to address this issue of limited resorption and osseointegration. The SPS owns the ability to simultaneously compact and sinter at relatively less severe processing conditions (compared to the conventional sintering technique), yielding novel results related to the ability to prevent BG devitrification and extreme reactions between the constituents. XRD analysis confirmed this unique ability to avoid excessive reaction and devitrification. The density analysis of the composites was performed through the Archimedes' principle. Microvicker hardness indentations were used to assess the hardness of each phase in the samples. The bioactivity analysis performed through immersion in simulated body fluid (SBF) displayed improved bioactivity of composite samples containing higher amount of BG. The *in vitro* biological behavior of SPSed composite samples was evaluated in human bone marrow derived mesenchymal stromal cells (hBMSCs). The *in vitro* hBMSCs attachment (using SEM), mineralization (using EDAX) and proliferation (using Alamar blue staining) were evaluated initially. In next stage, the osteogenic differentiation (evaluating BMP-2, collagen I and Osterix

formation) was analyzed by confocal laser scanning microscopy (CLSM). The SPSed HA-BG samples showed improved *in vitro* biological performance with higher BG content (particularly containing 30 wt % BG).

Keywords: Hydroxyapatite; tricalcium phosphate; osseointegration; Bioglass®45S5; spark plasma sintering.

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