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Editorial Column

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I am proud and extremely happy to be a part of the Editorial Board of this prestigious Journal of Powder Metallurgy and Mining for the last couple of years. During my journey along with our global research community we have witnessed many scientific break-through and milestone achievements in various fields related to this journal's interest. I would like to appreciate the contributions and efforts made by the authors, reviewers, and editorial board members who have made their valuable scientific support and without them it would not be possible for me to write this editorial column. It is my pleasure to high-light some of our laboratory's on-going research programme in the up-coming areas of nano-materials in green energy production and smart health care applications.

Among various forms of renewable energies, solar energy is considered as one of the largest single source of clean energy. However, the cost of energy based on the present solar technology is incomparable to those of fossil fuels. Highly efficient solar cells are necessary and need to be developed within next few years. Dye-Sensitized Solar Cells (DSSCs) are currently the leading third generation photovoltaic devices, which represent the cutting edge solar technologies with a high efficiency and low production cost. These cells normally consist of Transparent Conducting Oxide (TCO) films on a glass substrate, a wide band gap semiconductor, a ruthenium based dye, a redox electrolyte solution and a platinum counter electrode. Commonly, Fluorine doped Tin Oxide (FTO) coated glass is used as a substrate for both anode and cathode. To develop coatings for large-scale applications, it is mandatory to design a nano-dimensional SnO_2 material deposited on a glass for about few micron thicknesses. Currently we are developing such coating by Physical Vapour Deposition (PVD) or Pulse Laser Deposition (PLD) methods. We hope that such methods could bring down the cost factor of the resultant DSSC's to a greater extent and large scale production will eventually pave a way to solve the rural as well as urban energy demands through eructing giant solar panels. TiO_2 coatings with porous structure are also prepared and their materials properties are being studied.

It is well known that antibacterial materials are essential in our daily life and effectively protect the public health from pollutants including inorganic, organic and biological substances in many different forms. The pollutants not only physically interact with the membrane surface but also chemically degrade the membrane material. Various classes of antibacterial materials have been investigated namely, metal oxides, elemental-based nano-composites, polymeric-based nano-composites, ligand complexes, surfactants, antimicrobial peptides, plant extracts, aquatic extracts and fungus extracts. Amongst all the bactericidal agents, metal oxides have long been recognized for their potent antimicrobial applications and can be used on their own or in the form of nano-composites for enhanced stability. Therefore, currently we are incorporating them into the supports like surgical cloths which could be used as anti-bactericidal cloths in communities as well as in military applications.

Most processes proceeding in the human body occur at surfaces and interfaces of implant material. Surface properties improvement by nano-structured coatings represents a modern approach in material processing technologies, being recommendable to enhance qualities required for bio implant applications. Titanium and titanium alloy are widely used for biomedical applications due to their low density, excellent biocompatibility, corrosion resistance and mechanical properties. We are carrying out the study of biocompatibility of amorphous metallic glasses, transition metal nitides, oxides and oxy-nitrides in single layer, multilayers and nano composites. Ceramic coatings of hydroxyapatite are also done. We investigate the relationship between corrosion properties, mechanical properties and microstructure as well as bioactivity of the coated implantable substrates as they have got the potential applications in the fields of hard-tissue prosthesis, chronic electrode implants, catalyst support, fluid filters.

We are also involving in the development of Sm-doped-CeO_2 thin film production on Ti and Al substrates to employ them as environmental remediation catalysts for organic dyes present in the industrial effluents. In such works we are employing various nano-material processing methodologies along with thin film production techniques like, CVD and PVD as well.

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