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Editorial

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This year marks the 65th anniversary of the founding of The National Science Foundation (NSF) (see http://www.nsf.gov/about/). Since its inception in 1950, NSF continues to grow with its commitment to fundamental research and education in all scientific and engineering disciplines. It is to be noted here that, with an annual budget of $7.3 billion (FY 2015), almost one in four federally supported basic research studies, conducted by colleges and universities in the USA, is funded by NSF.

Efforts by agencies such as the NSF, Advanced Research Projects Agency – Energy (see http://arpa-e.energy.gov/) and others have elevated commitments, funding and support of research in materials science and engineering. One such effort is the program Delta – Delivering Efficient Local Thermal Amenities.[1] By bringing together a multi-disciplinary team of researchers from universities, industry and government,[2–4] the program supports a broad range of local thermal management systems (LTMS). Researchers participating in LTMS expect to offer solutions that will facilitate buildings to operate in the desired range of temperatures, while at the same time resulting in energy and cost savings, as well as a reduction in emissions. Such technologies range from on-body wearable devices to off-body installed systems. Examples such as the program Delta represent an integrated approach to materials, sensors, systems and infrastructure.

The first of the papers in this issue of *Emerging Materials Research* presents a study on the ‘Microstructure and property of WC/steel matrix composites’.[5] This research is a collaborative effort between the School of Chemical Engineering & Technology, China University of Mining & Technology, Xuzhou, the Jiangsu Key Laboratory of Large Engineering Equipment Detection and Control, Xuzhou Institute of Technology, Xuzhou, the Department of Mechanical Engineering, Xuzhou Bioengineering Technical College, Xuzhou and the Jiangsu Xinya Special Steel Forge Co. Ltd, Danyang, China. The authors present a study of steel matrix composites (SMCs) with 5CrNiMo steel as matrix and WC particles as hard phase. These composites were prepared by inductive electroslag casting technology. The influence of annealing, forging state and quenching tempering state on the microstructures of the particle-reinforced SMCs were investigated using the metallographic analysis method. The particle composition and the change in composition of the boundary were characterised by energy dispersive X-ray spectroscopy integrated with scanning electron microscopy, and the macro and microhardness were determined by Rockwell hardness tester and microhardness tester. The results show that, in most parts of the SMCs, the distribution of tungsten carbide (WC) particles was relatively uniform. White WC particles wrapped around a circle of black stripe Fe_3W_3C compound carbides. A certain thickness of the transition layer existed on the interface of the WC particle and steel matrix, and two kinds of WC grains for ‘iron rich’ and ‘iron poor’ appeared. The macro and microhardness of the composite material improved significantly than that of the 5CrNiMo steel after inductive electroslag casting.

The second paper in this issue focuses on the ‘Compression tests on aluminum honeycomb and epoxy resin sandwich panels’.[6] In this paper, the authors, from the Key Laboratory of Mechanical Reliability for Heavy Equipment and Large Structure of Hebei Province, Yanshan University, Qinhuangdao, China, discuss the functional integration and improvement in the bearing and energy absorption capability of an aluminum honeycomb sandwich panel under compression. By carrying out quasi-static compression experiments, the authors have investigated the absorption function of these panels with different resin thickness, diameter of aperture and thickness. Their experiments indicated that the energy absorption function of the aluminum honeycomb sandwich panel declined with increase in resin thickness and length of aperture, but improved with increase in specimen thickness.

‘Magnetoresistance of Co/Cu multilayer thin films’ is the third paper[7] in this issue of *Emerging Materials Research* by authors from the Bangabandhu Sheikh Mujibur Rahman Science and Technology University, Gopalgong, the University of Rajshahi, Department of Applied Physics and Electronic Engineering, Rajshahi, and the University of Information Technology and Sciences, Dhaka, Bangladesh. This paper reports a study on the multilayer nanostructures of ferromagnetic/nonmagnetic/ferromagnetic (Co/Cu/Co) thin films. The magnetoresistance of the multilayer was estimated by varying the thickness of the nonmagnetic spacer layer and the top ferromagnetic layer. The magnetic field was applied parallel to the current and the simulation was performed using Simulmag beta 2.0 software package. The spacer layer thickness was varied from 0.4 to 2 nm, and the top (free) layer was varied from 0.5 to 5 nm. It was observed that the magnetoresistance increases with the number of giant magnetoresistance (GMR) layers (e.g., multilayer GMR) up to a certain value of thickness of the spacer and free layer. The variation in the hysteresis loop was also analyzed by changing the polar angle.

‘Influence of bias voltage on sputter deposited V_2O_5 films’[8] is a collaborative effort between the Functional Nanomaterials & Devices Lab, Centre for Nanotechnology & Advanced Biomaterials and the

School of Electrical & Electronics Engineering, SASTRA University, Thanjavur, and the Solid State Physics Laboratory, New Delhi, India. In this study, vanadium pentoxide (V_2O_5) thin films were deposited over thoroughly cleaned silicon dioxide-coated silicon (Si) (100) substrates by reactive DC magnetron sputtering technique at various substrate bias voltages while keeping the other deposition parameters constant. The thickness of the films, measured using stylus probe technique, was in the range of 200 to 230 nm. The films were characterized for their structural, morphological, optical and electrical properties using X-ray diffraction, field emission scanning electron microscopy, UV-Vis spectroscopy and the four-point probe method, respectively. The crystallinity of the films improved at higher substrate bias voltages, which in turn had influence on the optical bandgap and electrical resistivity. The optical bandgap of the deposited films decreased to 2.68 eV from 2.71 eV as a result of the removal of defects. The temperature coefficient of resistivity of V_2O_5 films, deposited at -100 V, was found to be −1.9%/K. The results obtained are correlated to the substrate bias voltage.

Next in this issue is a study on 'Chemical modifications of poly (3-hydroxyalkanoates)'.[9] The authors, from the Department of Biomedical Engineering at the New Jersey Institute of Technology, report a survey of the chemical modifications of polyhydroxybutyrate, poly (3- hydroxybutyrate-co-3-hydroxyvalerate), poly (hydroxybutyrate-cohydroxyhexanoate) and polyhydroxyoctanoate. Microbially produced polyhydroxyalkanoates (PHAs) are fully biodegradable and biocompatible bio-polyesters. Several varieties of PHAs are directly produced by microbial fermentation. PHAs with tailor-made compositions can be synthesized by choosing an appropriate strain, carbon source and suitable cultivation conditions. However, some thermo-mechanical properties need to be improved for increasing the range of applications of these PHAs and this can be achieved by chemical modifications of microbially synthesized PHAs. To date, several chemical modifications of PHAs have been reported in the literature.

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