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Preface on thin films of advanced functional materials

Thin films of advanced functional materials or functional thin films comprise of a diverse range of applications such as energy storage, spintronics, magnetism, superconductivity, photovoltaics, photonics and plasmonics etc. Growth of such functional thin films can be realized using several physical or chemical vapour deposition processes such as molecular beam epitaxy (MBE), electron beam (e-beam) evaporation, pulsed laser deposition (PLD), magnetron sputtering (MS) using direct current (dc) or radio frequency (rf) or high power magnetron sputtering (HiPIMS), chemical vapour deposition (CVD), atomic layer deposition (ALD) etc. The aim of this special issue on functional thin films is to combine the thin film growth processes and to explore the structural, magnetic, electronic, optical and mechanical properties of the resulting thin films. The issue attracted a large number of contributions in which the majority was dedicated to energy storage, followed by magnetism, hard coatings and an ensemble of diverse areas. A summary of these publications is presented below by citing the name of first author of the publication.

Bharwal et al. studied plasticized I_2-free polysiloxane ionic conductors as electrolytes for stable and flexible solid-state dye-sensitized solar cells while Yadav et al. optimized inkjet printed $CuIn_{1-x}Ga_xSe_2$ thin film by controlled selenium distribution for improved power conversion efficiency in chalcopyrite solar cells. Markovskaya et al. investigated solid solutions of CdS and ZnS for their photocatalytic activity and photocurrent generation, Vavilapalli et al. studied electrochemical properties of brownmillerite structured $KBiFe_2O_5$ and Navidpour et al. concentrated on the photocatalytic activity of Zn_2SnO_4 coating deposited by air plasma spraying.

A large number of contributions were received on hard coatings, metal nitrides with focus on structural and mechanical properties including tribology and corrosion. Tillmann et al. studied various hard coatings e.g. the effect of bias voltage on TiN nanoparticle injection into CrN thin films in nc-TiN/nc-CrN composites, the impact of structure on the mechanical properties and oxidation behavior of magnetron sputtered cubic and hexagonal MoN_x thin films and structure and tribo-mechanical properties of Si and W containing amorphous carbon based multilayers. Jain et al. revealed the impact of thermal oxidation on the electrical transport and chemical & electronic structure of the GaN film grown on Si and sapphire substrates. Mundotia et al. tuned the bilayer period of AlN/CrN superlattice coatings deposited using cathodic arc technique for superior mechanical properties and thermal stability, Praveen et al. studied high-temperature oxidation and erosion of High-Velocity Oxy-Fuel (HVOF) sprayed NiCrSiB/Al_2O_3 and NiCrSiB/WC–Co coatings. It was discussed by Ferigita et al. and Ghuzali et al. that new oxo-pyrimidine derivatives as well as Clitoria ternaeter extracts doped sol gel coatings may act as corrosion inhibitors on mild steel and Shen et al. deposited Dy doped $Gd_2Zr_2O_7$ thermal barrier coatings and studied their thermal expansion coefficient, microstructure and failure mechanism .

In recent years ZnO-based thin films have attracted a significant attention for applications in several emerging areas. As a consequence several publications focussing on different dopings are found in this issue. Shatalov et al. studied the impact of ultralow yttrium concentration on formation, morphology and optical properties of dc magnetron co-sputtered yttrium-doped ZnO films, while Kaur et al. focused on the role of bound magnetic polaron model in Sm doped ZnO. Hariwal et al. found favorable tuning of optical absorbance, bandgap and surface roughness of ZnO thin films by C ion implantation. ZnO and TiO_2 thin films are also utilized as photocatalysts for photocatalytic degradation of Malachite Green via heterogeneous photoelectro-Fenton process by Hosseini et al.

Thin films of various magnetic materials also attracted a significant contribution. Hamed et al. studied active participation of inert YSZ substrates on interface formation in Fe_3O_4/YSZ heterostructures, Seema et al. investigated the interface-driven magnetic anisotropy of epitaxial Fe_4N thin films. Bera et al. identified the impact of surface morphology on magnetization dynamics of cobalt ultrathin films through an in-situ investigation and Dwivedi et al. studied structure and thermal stability of amorphous $Co_{23}Fe_{60}B_{17}$ film on Si substrate.

Contributions on several other emerging areas were also received e. g. Kumar et al. studied crystallographic structural and surface morphology of hydrothermally synthesized MoS_2 nanoflowers consisting of nanosheets, Haimi et al. studied the saturation profile measurement of atomic layer deposited film by X-ray microanalysis on lateral high-aspect-ratio structure, Kato et al. observed in-situ graphene by using an optical microscope, Sharma et al. studied high energy density pulsed argon plasma synthesized nanostructured tungsten for damage mitigation under fusion relevant energetic He ion irradiation, Pereira et al. investigated tetraethoxysilane (TEOS) thin films obtained by plasma polymerization on Ti_6Al_4V alloys and probed the influence of the deposition pressure on surface properties and cellular response. Zhu et al. performed electroprinting of multi-walled carbon nanotube (MWCNT)-assisted Polyvinylidene fluoride (PVDF) thin films with enhanced electrical properties, and Pliatsikas et al. probed edge-engineered self-assembled hierarchical plasmonic surface enhanced Raman scattering (SERS) templates.

A review on electrodeposited multilayer coatings from the point of view of fabrication, microstructure, properties and applications was published by Aliofkhazraei et al.

In conclusion, this special issue provides a significant advancement on functional thin films grown using physical and chemical vapour

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deposition techniques from the viewpoint of their structural, magnetic, electronic, optical and mechanical properties. We are thankful to Susan Li for the assistance, and to coordinating editor Andrei Rotaru and editor-in-chief Henrik Rudolph for the opportunity.

Guest Editors of the Special Issue Functional Thin Films Thin Films of Advanced Functional Materials: Growth and study of structural, magnetic, electronic, optical and mechanical properties.

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