

Multi-functional-multi-material nano-architectures for surface engineering applications

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Abstract

In today's world, artificially tailored materials meeting certain performance needs for surface protection are occupying centre stage of research and development. Such materials synergistically combine principles of nano-technology and practically available surface engineering techniques to deliver multiple functional attributes for high performance surfaces. Such functionality combinations can result in wear and oxidation resistance, desired hardness and transparency, anti-bacterial and photo-activity, hardness and wetting characteristics, hardness and low friction response among many others.

While surface engineering strategies by and large successfully relied on PVD, CVD and spray techniques, advancement in nano-technology has resulted in modification of some of the above processes for obtaining nano-scale surface engineered architectures based on functional nano-composites, nano-metric multilayers and compositionally gradient surface coatings.

Undoubtedly such architectures need to consist of multi-material multi-layers. There exists case studies where in oxidation behaviour of DLC coating is enhanced by Cr impregnations. Super-hardness attributes of transition metal nitrides like TiN/TiAlN, TiN/NbN are well known. The periodicity and thickness of the layers can be tailored to obtain a specific super-hardness value. Defect engineering in plasma synthesized transition metal nitrides can have a bearing of structure-property correlations. Post synthesis plasma exposure in several coatings can result in ultra low friction response from engineered surfaces. Such combinations pertain to surface and interface engineering that is quite impressive in terms of tribology outcomes as signalled from super-low values of friction in the order of 10⁻⁴ or less.

Biography

Sitaram Dash is a Sr. Scientist and Professor at the Department of Manufacturing Engineering of School of Mechanical Engineering (SMEC), Vellore Institute of Technology, Vellore, India. He has 20+ years of expertise and experience in Materials Engineering, Surface Engineering, Tribology and Nanotechnology. He has 100+ publication in the field of Material Science & Nanotechnology.

Publication

Novel single phase vanadium dioxide nanostructured films for methane sensing near room temperature



International Conference on Smart Materials and Nanotechnology | July 23-24, 2020

Abstract Citation: Sitaram Dash, Multi-functional-multi-material nano-architectures for surface engineering applications, Smart Materials Congress 2020, International Conference on Smart Materials and Nanotechnology, July 23-24, 2020, page 9