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Thermal stability and mechanical properties of nanostructured coatings for innovative applications in the oil and gas industry

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Abstract

Oil and gas exploration, development and delivery processes are often associated with high temperature and high pressure applications in chemically aggressive conditions. This requires materials that have; (i) long-term thermal stability, (ii) high mechanical strength and dimensional stability, (iii) high resistance to abrasive and chemical wear, and (iv) low particle generation and low outgassing for reduced contamination. This requires new and innovative materials that possess a unique combination of properties. Over the years, a number of coatings have been developed to successfully deliver resistance to high temperatures, abrasive and wear resistance, as well as high strength and durability in a number of applications such as machining tools, automotive, and semiconductors. In such and similar applications, coatings have been known to have improved the wear performance and life of the coated part in their applications. While most of the currently available coatings have been developed to enhance the properties of cutting tools in the machine tool industry, nano-structured coatings can in principle be used for a variety of high temperature applications in the oil and gas industry. This paper explores the possibilities of designing, developing and optimizing nano-structured coatings that can be deposited on candidate mechanical components in a bid to enhance the mechanical properties and improve the degradation characteristics for new and innovative materials applications. A comprehensive study of the high temperature stability and degradation characterization of several advanced nanostructured coatings originally developed for tooling protection was carried out. Test samples were commercial prepared by means of the physical deposition technique (PVD). The aim of the study was to investigate the properties of several nanostructured coatings for innovative applications in the oil and gas industry. Results of the study indicate that it is possible to identify, develop and characterize coating compositions that possess various combinations of physical, chemical and mechanical properties for use in a number of new applications in the oil and gas industry.

Biography

Farayi Musharavati has completed his Ph.D. at the age of 40 years from University Putra Malaysia. He has had 5 years industrial experience prior to his doctoral studies. He is currently an assistant professor of industrial engineering at Qatar University. As part of his development in the academic field, he has a keen interest in the broad field of materials and manufacturing engineering. He has published more than 20 papers in reputed journals and is serving as an editorial board member of repute.