

Ludvik Martinu, Polytechnique Montreal

Title: “Vapor-deposited functional coatings: Impactful opportunities for aerospace applications”

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Abstract:

Synthesis of films and coatings by vacuum-based vapor deposition processes allows one to tailor the microstructure and composition in order to obtain well-controlled functional and multifunctional characteristics combining the mechanical, tribological, electro-chemical, optical, electrical and other properties, as well as the coating system durability in the harsh environments. This presentation will describe a holistic approach to functional coatings and surface engineering relying on an in-depth knowledge of the interplay between the material, process and microstructure with respect to the final performance. In the first part, we will provide a brief overview of the advances in film fabrication technologies employing physical vapor deposition (PVD, in particular, magnetron sputtering including HiPIMS, and vacuum arc deposition) and chemical vapor deposition (CVD, in particular, plasma enhanced CVD (PECVD), and atomic layer deposition (ALD)), with a particular emphasis on the understanding of energetic surface interactions for controlling the evolution of coating microstructure on the nanoscale. In the second part, we will illustrate the challenges, progress and new opportunities in the development of functional coatings for aerospace and outer space applications by specific examples and case studies considering different components of aircraft and satellites. Selected examples will include:

- a) Nano-structured and duplex protective coatings against solid particle erosion, high temperature oxidation, and ice accretion;
- b) Near-infrared optical properties of thermal barrier coatings subjected to CMAS infiltration;
- c) Static and dynamic optical coatings for enhanced vision and energy control using electrochromic and thermochromic systems for smart windows and smart radiators.

Future perspectives with respect to process and material optimization for coating 2D and 3D components, as well as increasingly demanding performance, durability and sustainability will be discussed.

Biography:



Ludvik Martinu is Professor at Polytechnique Montreal, Canada, in the Department of Engineering Physics, Polytechnique Chair in Multifunctional Coatings and Surface Engineering, and Director of the Thin Film Science and Technology Research Center on the Campus of the University of Montreal.

He obtained his Master's and PhD degrees from Charles University in Prague. After joining Polytechnique Montreal, Canada in 1988, he became Professor in 1994, and he served as Head of the Department of Engineering Physics in 2004-2010. He has been strongly involved in the scientific societies, in particular as President and Vice-President of the Society of Vacuum Coaters (2010-2016). His main research interests are surface engineering, optical, tribological and multifunctional thin films and coatings, plasma processing of materials, and development of university-industry partnerships. His activities resulted in more than 420 publications in refereed journals, book chapters, and conference proceedings, and in 22 patents and more than 80 invited, keynote and plenary lectures at international conferences. He is recipient of numerous special awards including those from the SVC, AVS, NSERC, and recently the Polytechnique's Award for Excellence in Research and Innovation.