

International Conference and Expo on International Science & Engineering

October 22-24, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Homogeneity measures in functionally graded materials

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The goal of the paper are numerical investigations of the influence of functionally graded materials (FGM) thermo-mechanical properties on the final internal stresses states in the coating. These layers are the modification of commonly used multilayer coatings deposited via Physical Vapor Deposition techniques (PVD), and can be highly effective in order to maximize the adhesion, hardness and thermal stability. Physical and mathematical models of the layers and substrate were created basing on classical theory of elasto-plastic materials. For the sake of mathematical modeling a transition functions, describing continuous physico-chemical material's parameters changes in each layer of K-layered coating were postulated. The transition layers were modeled using monotonic, nonlinear and asymmetric functions. For FGM assessment purposes measures of asymmetry and nonlinearity of the transitional functions were created. Using defined measures the degree of nonlinearity and asymmetry of postulated gradient layers was calculated. For practical purposes it was convenient to carry out investigations on specific representatives of the given transition function class. Then obtained results were expanded to remaining representatives (elements) of the class. Introduction of this measures is a step towards creating a universal sets of widely used metrics for functionally graded layers. This measures will enable the simultaneous assessment of influence of transitional function properties on the global character of gradient layer.

Research issues of FGM measurability are extremely important for the sake of the intelligent computer-aided design and optimization of PVD deposition processes software creation.

Biography

Jerzy Ratajski has completed his Ph.D in Institute of Precision Mechanics in Warsaw in 1986. In 2004 he completed DSc in Częstochowa University of Technology. His research field is related with surface engineering, thermo-chemical treatment, vacuum-plasma technologies and mathematical modeling of nitriding and PVD processes. He has published more than 80 papers in reputed journals and attended and presented research papers in more than 100 seminars/conferences in and out of the country. He has managed several research projects.

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