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FEM application in studies of mechanical properties of the C-Pd film

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ABSTRACT

Comparison of numerical simulation and experimental data for nanoindentation studies of nanostructural carbonaceous-palladium films (C-Pd) is presented.

Finite Element Method (FEM) and ANSYS program (Ansys, Inc) were used. Traditional Oliver–Pharr method for cone and spherical shaped indenter were applied for FEM modelling of nanoindentation experiment. FEM simulations showed that Pd nanograins are moved in carbon matrix toward the film surface due to an external stress. Distribution of palladium grains in the film volume influence on the Young modulus and nanohardness was also found.

1. INTRODUCTION

Mechanical properties of new nanomaterials are particularly interesting due to the possibility innovative applications. Properties of such materials on the nanometer scale might differ from those of a bulk material of the same composition. Nanoindentation investigations of films containing Pd nanograins are difficult because topography and/or structure of films and contents of Pd in the films significantly affect their nanomechanical properties. Such films could be applied as an active layer in many types of sensors. C-Pd films chemical, mechanical and physical properties depend on palladium nanograins and carbonaceous matrix structure [1, 2]. One of new methods of investigations of nanomechanical properties is nanoindentation method. This method is designed to measure the nanomaterial's mechanical properties such as nanohardness and reduced modulus of elasticity [3]. In this technique, the indenter is placed on very small depth into materal.