

Temperature-induced changes in the topography and morphology of C–nPd films deposited on fused silica

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Changes in superficial and structural properties in carbonaceous–palladium (C–Pd) films prepared by PVD method, induced by annealing them in an inert atmosphere were studied. C–Pd films with different Pd content in a carbon matrix were investigated. SEM observation after heat treatment showed the agglomeration of palladium nanograins into bigger grains and significant changes in a topography and morphology of C–Pd films. XRD studies confirmed the formation of big (more than 100 nm in diameter) Pd nanograins as a result of the annealing process. FTIR studies showed that C–Pd films from PVD process contained fullerene C₆₀ and palladium acetate (films precursors), which were decomposed during the annealing process.

Keywords: carbonaceous–palladium film, PVD, XRD, SEM, FTIR.

1. Introduction

The structure and the composition of carbonaceous–nanopalladium (C–nPd) films, that are new material proposed for hydrogen sensors or hydrogen storage, affect their sensing or storing properties. This type of material can appear in the various structural forms of both components: palladium and carbon matrix. Nanopalladium can be found in the form of nanoparticles, nanowires or nanocrystallites, whereas the carbon matrix can be porous, amorphous carbon or higher ordered nanostructures. The structure of palladium is of a great importance taking into account the hydrogen sensing properties of C–nPd films. There are known several crystalline forms of palladium, palladium-oxide and palladium hydride (PdH_x) phases. Bulk palladium is the *fcc* structure, with the lattice constant $a = 0.3890$ nm. For this *fcc* structure, the diffraction peaks with the largest intensity are observed at 0.2246 and 0.1945 nm, which is ascribed to (111) and (200) lattice planes, respectively. Palladium can also form icosahedral, decahedral or *fcc* nanoclusters depending on the cluster diameter, with the size regime for cluster stability computed by molecular dynamics [1].