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Morphological, topographical and FTIR characterizations of Pd–C films

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The structure, topography and morphology of Pd–C films were studied by AFM (atomic force microscopy), SEM (scanning electron microscopy), Raman and FTIR (Fourier transform infrared spectroscopy) methods. It was found that an increasing content of palladium in films causes a decrease in their roughness and size of nanograins. The topography and morphology of Pd–C films depend on the content of palladium in the film, what was found from the analysis of SEM and AFM images. FTIR and Raman spectra show that the content of fullerene and palladium in the film strongly depends on technological parameters of PVD (physical vapor deposition) process.

Keywords: palladium nanocrystals, fullerene, PVD.

1. Introduction

The reactions of transition metal complexes with fullerenes result in the formation of an interesting array of new compounds. Some reactions lead to the formation of new complexes by an addition of ligating groups to the fullerene so that the metal center is attached to the fullerene through some type of a bridging arrangement [1]. It was also found that C_{60} with some compounds and transition metals form polymers. For example, the existence of $C_{60}Pd_n$ was proposed [2]. Polymeric materials with higher Pd/C_{60} ratios are believed to have palladium atoms that cross-link two chains. Heating solid $C_{60}Pd_1$ in toluene results in the partial dissolution of C_{60} and the formation of a solid with a Pd/C_{60} ratio between 2 and 3. These polymers have also been examined by electron microscopy [3]. For $C_{60}Pd_3$, one-fourth of the sample consisted of small crystals of Pd in an amorphous matrix. The rest of the sample was free of Pd crystals and showed local crystallinity. Ten percent of the material gave an electron diffraction pattern that was interpreted in terms of a model of a $C_{60}Pd_6$ octahedral unit with each palladium center bridging two fullerene units. For studying of structural properties of