Raman study of Pd-C films for H-sensors

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The specific properties of the palladium-carbon (Pd-C) layers, resulting from their molecular structure, enable to use them for constructing hydrogen sensors [1]. These layers have a nanofoam structure [2] containing both palladium nanocrystallites of different sizes and specific molecular structures, the nature of which requires further studies. These structures are sensitive to the presence of hydrogen, while the highly-developed surface of carbon nanofoam increase the sensor's sensitivity.

This works presents the results of studying Pd-C layers using Raman spectroscopy, providing detailed information on intra- and intermolecular interactions. This method has been used for studying layers having various palladium content, obtained by different methods (PVD process and two-stage PVD/CVD process [2,3]). For layers obtained by PVD process, the vibrations bands characteristic of C_{60} fullerene molecules and defective graphite layers (D and G bands) were observed in the spectra, whereas for layers obtained by PVD/CVD method the Raman spectra displayed only D and G bands characteristic solely of graphite-like layers' vibrations.

The analysis of the Raman spectra obtained reveals that the maximum re-positioning of bands characteristic of carbon structures is affected by many parameters, including the size of palladium nanocrystallites and thus, the percentage content of this metal in the studied layer. The quantitative analysis of spectra for layers obtained in PVD/CVD process shows the difference in the relative intensity of bands D and G, reflecting the different degrees of graphitization in the investigated layers.

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