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Highly sensitive infrared absorption spectroscopy of functionalized diamond surface

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Diamond is attractive semiconductor material for bio-electronics and electrochemical applications especially for biosensors or DNA chips because of excellent electrical, optical, thermal, chemical, and biocompatible properties. Moreover, diamond due to possibility of its surface functionalization is very important interface to biological molecules. Fourier transform infrared (FTIR) spectroscopy is one of the fundamental analytical techniques for a detailed analysis of surface chemistry.

In this contribution we report on the grazing angle reflection (GAR) spectroscopy of functionalized diamond surface employing gold optical mirrors coated by nanoporous diamond layers. Nanoporous diamond layers with thickness about 100 nm on Au mirrors are grown at 350°C using the large area linear antenna microwave plasma system Roth&Rau AK 400 [1]. We show that due to the large surface area of nanoporous diamond layers GAR is sensitive enough for the detection of functional groups on the functionalized diamond surface on the atomic level. Based on IR spectra we compare and discuss the difference in plasma hydrogenated, oxidized, fluorinated, and aminated diamond surfaces. We show clear correlation between FTIR and XPS measurements indicating that the spectra of hydrogenated diamond surfaces are dominated by C-H groups. The IR spectra of oxidized diamond are dominated by hydroxyl and carbonyl groups. The spectra of fluorinated and aminated diamond surfaces confirm the presence of C-F and NH_2 bonds, respectively. The obtained results are supported by data from SEM, Raman spectroscopy, current-voltage and wetting angle measurements.

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1. *Kozak H., Babchenko O., Artemenko A., Ukraintsev E., Remes Z., Rezek B., Kromka A.* Nanostructured diamond layers enhance the infrared spectroscopy of biomolecules // Langmuir-2014.-**30(8)**.-P. 2054-2060.