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Growth of Carbon Materials on Gold Substrate by Plasma Enhanced CVD

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Carbon is a versatile building element of many interesting materials that have already find practical applications in the form of thin films (diamond, DLC) or potential applications in the form of nanostructures (fullerenes, carbon nanotubes, graphene). For electronics or sensors, it is important to provide a very good contact to the functional structures. Gold is the best choice taking into account its inertness, i.e. oxidation resistance. From this point of view the investigation of the growth of carbon materials on gold is important. However, the interaction of hydrogen and hydrocarbon plasmas and growing carbon material with an inert gold surface is of high interest in basic research too.
Amorphous hydrocarbon films and carbon nanotubes (CNTs) were prepared on gold substrate by means of plasma enhanced chemical vapor deposition (PECVD) and thermal CVD for comparison. Thin iron film (5 nm) was used as catalyst in case of CNTs synthesis. Three types of discharges were employed for this study, namely (i) a low pressure (8 kPa) dual frequency discharge (2.45 GHz and 13.56 MHz) in the mixture of H2 and CH4; (ii) a capillary plasma jet operating at 27.12 MHz in Ar/H2/CH4 gas mixture; (iii) a microwave torch (2.45 GHz) at atmospheric pressure in Ar/H2/CH4. The low and atmospheric pressure thermal CVD proceeded in the same gas mixtures as above. The surface morphology of the deposits was investigated by a high resolution scanning electron microscopy (HRSEM) and structure profiles were observed with a help of focused ion beam ablation. Laser desorption ionization (LDI) combined with time-of-flight mass spectrometry and infrared reflection absorption spectroscopy (IRRAS) were applied to study chemical composition. A creation of rarely observed gold-related clusters was observed by LDI and related to infrared absorption peaks.

Keywords
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