Pulsed Laser Modification of Properties of Nano-carbon Based Thin Films for Chemical Sensor Applications

J. Vlček*, P. Fitl, P. Hozák, D. Tomeček, E. Marešová, , M. Vrňata
Department of Physics and Measurements, University of Chemistry and Technology, Technická 5, 16628 Prague, Czech Republic

F. Fendrych, L. Peksa, L. Fekete
Institute of Physics AS CR, Na Slovance 2, 18221 Prague, Czech Republic

Carbon nanomaterial thin films based on nanocrystalline diamond films and fullerenes thin films are promising materials to use in semiconducting gas sensing as an active layer. One of key points for chemical sensing is controlling of the surface properties of an active layer (e.g. surface functionalization, surface roughness, grain size, porosity and specific surface area, etc.). Morphological and chemical modification of those layers can be done easily by involving laser treatment.

In this contribution we present laser treatment of nanodiamond and fullerene C_{60} thin films. We use pulsed UV nanosecond laser Nd:YAG at the fourth harmonic frequency ($\lambda = 266$ nm) with peak power of 10 MW for exposure of carbon materials. In case of nanodiamond we laser treated nanodiamond seeds on Si substrate under different conditions (ambient atmosphere of Ar, O_2, He) prior microwave PE CVD deposition [1]. In case of C_{60} we laser treated previously grown C_{60} films with thickness of 200 nm prepared by high vacuum thermal evaporation. Surface properties were studied systematically in terms of morphology (AFM, SEM imaging), and in terms of chemical composition (Raman spectroscopy, XPS). We connect results of study with mechanisms, which carry out during laser beam interaction with solid-state carbon materials. We present also easy one-step way of thin film patterning by laser treatment, even in case of nanocrystalline diamond films patterning.

References

[1] Vlček J. et al, J Phys D Appl Phys **46**, 3 (2013).

* jan.vlcek@vscht.cz