(Invited) Nitrogen Functionalization and Doping of Conductive Carbons By Means of Low Temperature Plasmas

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Nanomaterials, such as nanocomposites, nanorods, nanotubes and graphenes, are nowadays almost past the title “novel materials”, they have been widely investigated and used as either promising or already proven materials for various applications ranging from electronics and black body coatings to fuel cells and supercapacitors. Such advanced nanomaterials, independently of their chemical composition, are also used for the delivery of therapeutic agents, including biomolecules targeting disease sites, for bioimaging, or in general for biomedical engineering.

This contribution presents several examples of plasma synthesized and plasma functionalized carbon based nanomaterials (nanostructures), CBNs, which nowadays play an important role for biomedical engineering, and in particular for the development of novel biosensors. The examples presented in this paper concern materials which are synthesized in low pressure RF plasmas from hydrocarbon precursors, like ethylene, with or without nitrogen presence during their growth. Most of the examples are vertically aligned graphene flakes. The post-treatment of these materials is performed in low pressure radio frequency capacitively coupled plasma and microwave plasma. In this contribution we will focus on surface treatment by nitrogen and ammonia plasma. The goal of such surface treatments with nitrogen containing plasma is doping and functionalization, very often simultaneously obtained. Plasmas were controlled by means of mass spectroscopy.

The method of choice for the analysis of the bonding situation of the materials before and after treatment in this presentation is near edge X-ray absorption fine structure spectroscopy (NEXAFS), and X ray photoemission spectroscopy (XPS) performed on HESGM beamline, HBZ Bessy II Germany.

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