

SPECTROSCOPIC STUDY OF CARBON NITRIDE NANOPARTICLES SYNTHESISED BY LASER PYROLYSIS UNDER OXIDISING ATMOSPHERE

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Introduction. The study of the amorphous carbon-nitrogen alloys ($a\text{-CN}_x$) films have shown that the structural, electronic and mechanical properties, which are strongly dependent on the bonding configuration structure (sp^1 , sp^2 , sp^3), can be deeply modified by hydrogen and nitrogen incorporation [1, 2, 3, 4]. The incorporation of nitrogen is in turn greatly influenced by the preparation methods. The effects of nitrogen differ when nitrogen atoms enter the sp^2 clusters, by modifying the π -bond states distribution or the sp^3 network [5].

Experimental purpose. To understand the incorporation conditions of nitrogen, CN_x nanopowders were synthesised by laser pyrolysis which method has been improved for the elaboration of carbon particles [6]. We present here the laser pyrolysis synthesis of nanosized carbon nitride powders obtained via the injection of a mixing of gaseous precursor ethylene (C_2H_4), mono-methyl-amine (MMA) as nitrogen provider under oxidising atmosphere through a flow of N_2O . Indeed we already know that an oxidant atmosphere, promotes the formation of structured carbon nano-particles as fullerenes for a ratio C/O close to 1.2 in the gas mixture [7]. The spectroscopic study of CN_x nanopowders is reported: the bonding structure was determined using Infrared analysis (FTIR) and the nano-texture followed by electron microscopy. The electronic structure is deduced from Near Edge X-Ray Absorption Fine Structure (NEXAFS) study,

Results. The different characterisations point out a nitrogen incorporation up to 20% [8]. Those concentrations increase when the ratio C/O decreases. Furthermore we note an evolution of both the carbon-carbon and the carbon-nitrogen bonding type with C/O and the nitrogen concentration. The carbon sub-network is mostly sp^2 and depends on the C/O ratio at low nitrogen incorporation. A good correlation is found between the evolution of the empty π^* electron states and the evolution of the bonding configuration. These results will be compared to the characteristic features shown by the bonding and electronic structure of the sp^2 CN_x films, elaborated by radio-frequency magnetron sputtering (RFMS) [9, 10]. We show

that the evolution of the electronic structure in highly concentrated powders is due to conjugation configurations involving C≡N bonding.

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