

Ultrashort Pulsed Laser Deposition for the direct synthesis of NitrogenDoped Graphene

C. Maddi^a, T. Tite^a, V. Barnier^b, F. Bourquard^a, S. Reynaud^a, J. -Y. Michalon^a, A. S. Loir^a, K. Wolski^b, C. Donnet^a, F. Garrelie^a

^a *Université de Lyon (France), Laboratoire Hubert Curien (UMR 5516), Université Jean Monnet, 42000 Saint-Étienne, France*

^b *Laboratoire Georges Friedel (UMR 5307), Ecole Nationale Supérieure des Mines, 42023 Saint-Etienne, France*

Abstract

Graphene and its derivative are attracting a lot of attention today due to their growing range of applications. This highlights the need to look for new synthesis routes, which allow better tailoring of graphene based materials properties as well as simplifying synthesis methods. In particular, nitrogen doping appears as an interesting option to modify the electrochemical properties of graphene. Meanwhile, the pulsed laser deposition of graphene proved efficient to produce multilayer graphene for applications in the domain of biosensors. In this work, N-doped graphene synthesis was performed through femtosecond pulsed laser ablation of graphite in a nitrogen environment, and vacuum annealing of the deposited material. Nitrogen doping and structural properties of the material were evaluated via different characterization techniques. C-N bonding configurations as well as N contents have been evaluated by X-ray photoelectron spectroscopy. Raman mapping showed the decrease of the 2D peak intensity compared to pure graphene, as well as a decrease in crystalline size (L_a), allowing to check the homogeneity of the doping. XPS studies showed that N atoms appear to be mainly in the pyridinic type of bonding, with contents going up to 3 % atomic. This kind of bonding, coupled with the versatility of this fast and low temperature approach, make the produced N-doped graphene a promising materials for electrochemical sensors, targeting biosensors applications.