

Graphene and Boron-doped Graphene by Pulsed Laser Deposition

C. DONNET

Y. BLEU, F. BOURQUARD, A.-S. LOIR, S. REYNAUD, Y. LEFKIR, F. GARRELIE

Université de Lyon, Laboratoire Hubert Curien UMR 5516, Université Jean Monnet, Saint-Étienne, France

V. BARNIER

Université de Lyon, Mines Saint-Etienne, CNRS, Laboratoire Georges Friedel UMR 5307 CNRS, F-42023 Saint-Etienne, France

C. FARRE, C. CHAIX

Université de Lyon, Institut des Sciences Analytiques, UMR 5280 CNRS, Université Claude Bernard Lyon 1, F-69100 Villeurbanne, France

Christophe.Donnet@univ-st-etienne.fr

Among various physical vapor deposition (PVD) processes used to produce graphene as an alternative route to chemical vapor deposition (CVD) processes, pulsed laser deposition (PLD) is a versatile process to synthesize graphene materials, mainly for dopant incorporation in a controlled and reproducible way to modulate the graphene properties. By considering a short review on graphene synthesis by PLD [1-4], the present contribution is focused on the synthesis and characterization of few-layer graphene and boron doped-graphene films obtained by vacuum thermal heating (500-900°C) of thin amorphous carbon-based films (a-C, a-C:B) synthesized by PLD in the presence of a nickel catalyst. The growth mechanism is highlighted on the basis of *in situ* XPS investigations during graphene growth [5]. The film characteristics are discussed mainly in terms of layer nano-architecture, lateral homogeneity and boron chemistry, on the basis of Raman, XPS/AES and HRTEM/EELS investigations [6-7]. The effect of boron doping on graphene electronic or electrochemical properties is investigated. It will be shown that PLD can produce few-layer graphene (within 2-5 layers) with tunable electrochemical properties through an accurate control of the boron doping concentration [8].

REFERENCES

- [1] Y. Bleu, F. Bourquard, T. Tite, A.-S. Loir, C. Maddi, C. Donnet, F. Garrelie, *Frontier in Chemistry* 6 (2018) 572 (18 pp)
- [2] F. Bourquard, C. Donnet, F. Garrelie, A.-S. Loir, F. Vocanson, V. Barnier, C. Chaix, C. Farre, N. Jaffrezic-Renault, F. Lagarde, G. Raimondi, *Handbook of Graphene*, B. Palys (ed.), Scrivener Publishing LLC, Vol. 6 (2019) 483-508
- [3] Y. Bleu, F. Bourquard, A.-S. Loir, V. Barnier, F. Garrelie, C. Donnet, *J. of Raman Spect.* 50 (2019) 1630-1641
- [4] Y. Bleu, F. Bourquard, V. Gartiser, A.-S. Loir, B. Caja-Munoz, J. Avila, V. Barnier, F. Garrelie, C. Donnet, *Mat. Chem. Phys.* 238 (2019) 121905
- [5] Y. Bleu, V. Barnier, F. Christien, F. Bourquard, A.-S. Loir, F. Garrelie, C. Donnet, *Carbon* 155 (2019) 410-420
- [6] Y. Bleu, F. Bourquard, V. Barnier, Y. Lefkir, S. Reynaud, A.-S. Loir, F. Garrelie, C. Donnet, *Applied Surface Science* 513 (2020) 145843
- [7] Y. Bleu, F. Bourquard, J.-Y. Michalon, Y. Lefkir, S. Reynaud, A.-S. Loir, V. Barnier, F. Garrelie, C. Donnet, *Applied Surface Science*, in press, <https://doi.org/10.1016/j.apsusc.2021.149492>
- [8] Y. Bleu, F. Bourquard, C. Farre, C. Chaix, J. Galipaud, A.-S. Loir, V. Barnier, F. Garrelie, C. Donnet, *Diamond and Related Materials* 115 (2021) 108382

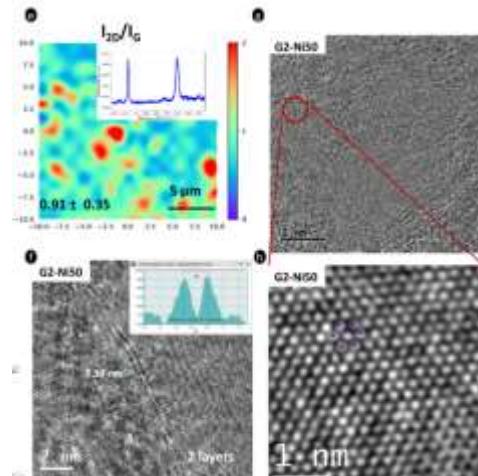


Figure 1: Raman and HRTEM images of as-synthesized graphene from PLD, using a 50 nm thick nickel catalyst film. From [7].