



**HAL**  
open science

## **XPS investigation of surface graphitized nanodiamonds: evidence of a nano effect**

F Ducrozet, H Girard, J Leroy, E Larquet, I Florea, E Brun, C Sicard-Roselli,  
Jean-Charles Arnault

### ► **To cite this version:**

F Ducrozet, H Girard, J Leroy, E Larquet, I Florea, et al.. XPS investigation of surface graphitized nanodiamonds: evidence of a nano effect. MRS Spring Meeting, May 2022, Online, France. cea-03681019

**HAL Id: cea-03681019**

**<https://cea.hal.science/cea-03681019v1>**

Submitted on 30 May 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## **XPS investigation of surface graphitized nanodiamonds: evidence of a nano effect**

F. Ducrozet<sup>1,2</sup>, H. A. Girard<sup>1</sup>, J. Leroy<sup>1</sup>, E. Larquet<sup>3</sup>, I. Florea<sup>4</sup>, E. Brun<sup>2</sup>, C. Sicard-Roselli<sup>2</sup>, J. C. Arnault<sup>1</sup>

<sup>1</sup> Université Paris-Saclay, CEA, CNRS, NIMBE, CEDEX, 91 191 Gif sur Yvette, France;

<sup>2</sup> Institut de Chimie Physique, UMR 8000, CNRS, Université Paris-Saclay, Orsay 91405, France;

<sup>3</sup> Condensed Matter Physics Laboratory, UMR CNRS 7643, Ecole Polytechnique, IP-Paris, 91228 Palaiseau, France;

<sup>4</sup> Laboratory of Physics of Interfaces and Thin Films, UMR CNRS 7647, Ecole Polytechnique, IP-Paris, 91228 Palaiseau, France;

The X-ray photoemission (XPS) spectroscopy is a suitable technique to finely characterize the surface chemistry and the reactivity of nanodiamonds (ND) [1]. Nevertheless, the interpretation of XPS spectra needs to be carefully considered as the ND size becomes comparable to the photoelectrons inelastic mean free path in diamond, namely a few nanometers [2]. In that case, due to geometrical consideration, an enhancement of the carbon signal occurs, as reported by Baer et al [3].

In the present study, detonation nanodiamonds were annealed between 800 and 950°C under vacuum or argon atmospheres to form sp<sup>2</sup> carbon at their surface [4]. The monitoring by XPS of induced modifications versus the annealing temperature will be presented. Results will be then compared to HR-TEM, FTIR and Raman measurements. According to XPS, the part of sp<sup>2</sup> carbon rises up to 30% for detonation ND annealed at 1100 °C under vacuum. Looking to HR-TEM images, the graphitization is only limited to the first outer shell. This is explained by a nano effect which exalts the extreme surface chemistry of detonation ND by a factor of 2.5 in the C1s core level.

### **References**

- [1] Arnault, *Diam. Relat. Mater.* 84 (2018) 157
- [2] Tanuma et al, *Surf. Interface Anal.* 43 (2011) 689
- [3] Baer et al, *J. Surf. Anal.* 12 (2005) 101
- [4] Ducrozet et al, *Nanomaterials* 11 (2021) 2671