FINAL MASTER PROJECT PROPOSAL

Title

In-situ Microscopy Analyses of Carbon and Related Nanostructures

Supervisor(s)

Raul Arenal; Instituto de Nanociencia de Aragon (INA)

Summary of the project

Carbon-based or related nanostructures (hexagonal boron nitride, molybdenum disulfide…) are very promising nanomaterials due to their attractive mechanical, thermal and electronic properties. However, to open an even wider field of applications, being used in a specific function, a possible fine tuning of their properties is often required [1]. In-situ transmission electron microscopy (TEM) is a very appropriate approach for achieving these goals at the atomic scale, as well as for investigating the atomic structure and configuration of these nanomaterials under particular conditions [2-4]. Thus, this Master Project is dealing with these challenging aspects: deep investigation, manipulation and control of the properties of these individual 1D and/or 2D nanostructured materials. Further studies in the framework a PhD thesis can be undertaken.

These works will be developed using advanced microscopy techniques and TEM instruments at the Instituto de Nanociencia de Aragon (INA). The use of a recently acquired heating and biasing TEM holder, offering ultra-high stability (attaining atomic resolution at high temperatures (1200 C)), will allow getting this information at the local (atomic) level.

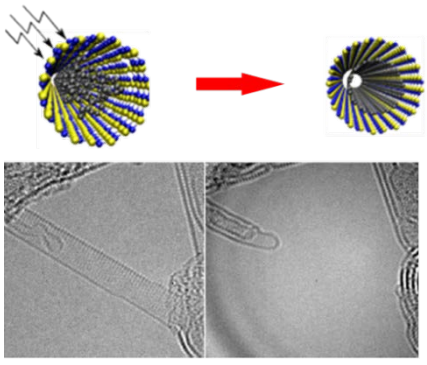

Figure illustrating TEM in-situ works: scheme (top) and HRTEM images displaying the formation process of a crystalline Carbon nanotube (NT) from amorphous C encapsulated in a boron nitride NT under electron beam irradiation [3].

[1] R. Arenal, X. Blase, A. Loiseau, Advances in Physics 59, 101 (2010).
[2] F. Banhart, World Scientific, Singapore (2008).
[3] R. Arenal and A. Lopez-Bezanilla, ACS Nano 8, 8419–8425 (2014).
[4] M. Pelaez-Fernandez, A. Carrillo, A. Benito, W. Maser, R. Arenal, to be submitted.
[5] http://raularenal.com/