Development and Characterization of Ni_xPt_{1-x} Nanoalloy; Analysis of Carbon Solubility Effects in Catalysed Carbon Nanotubes Growth

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Nowadays, Chemical Vapor Deposition (CVD) on catalytic nanoparticles (NPs) is the most studied and promising method for single wall carbon nanotubes (SWCNT) synthesis. However, this process suffers from a lack of control of tube diameter and chirality, which directly influence tube properties (conducting/semiconducting)[1]. This non-selectivity is due to an insufficient knowledge of the parameters controlling the growth mechanisms. One of the research path focuses on the catalytic NPs role, and notably its carbon solubility. In order to inspect deeper the role of this parameter, we have studied the influence of Ni_xPt_{1-x} NP on the SWNT growth. Nickel is indeed known to be an efficient catalyst for the CNTs growth thanks to its ability to solubilize carbon, unlike platinum [2]. We used the colloidal route to synthesize five compositions of Ni_xPt_{1-x} NPs (pure Ni, Ni_3Pt, NiPt, $NiPt_3$ and pure Pt) and obtain monodisperse alloyed NPs, with size and shape control and homogeneous compositions. Structure and chemical composition of the NPs are fully characterized before and after NTCs growth (Transmission Electron Microscopy, Energy-Dispersive X-ray spectroscopy, Electron diffraction). Further, we used the LPICM FENIX platform, which is able to reproduce CVD environment growth coupled with surface analysis techniques follow-up (XPS, AES, LEED ...), to detect any NPs chemical changes during CNTs growth. Finally, we performed *in-situ* CNTs growth in an FEI Titan ETEM to study the interplay between chemical composition of the catalytic NPs and SWNT growth mode.

[1] V. Jourdain and C. Bichara, Carbon **58**, 2-39 (2013)
[2] A. Castan, S. Forel, L. Catala, I. Florea, F. Fossard, F. Bouanis, A. Andrieux-Ledier, S. Mazerat, T. Mallah, V. Huc, A. Loiseau, C.S. Cojocaru, Carbon **123**, 583-592 (2017)