CVD graphene growth on Ni films and transfer

Geetanjali Deokar, J.-L. Codron, C. Boyaval, X. Wallart, D. Vignaud
Institute of Electronics Microelectronics and Nanotechnology, University of Lille 1
Av. Poincaré CS 60069
59652 Villeneuve d'Ascq Cedex, France
geetanjali.deokar@iemn.univ-lille1.fr

The graphene growth onto metal foils and thin films is currently the leading method for producing large, continuous graphene films. Due to the small lattice mismatch between Ni (111) and graphene, for epitaxial and homogeneous growth of graphene, Ni (111) is a promising substrate. However, on Ni graphene growth occurs via segregation of carbon, which is a difficult process to understand and control. We present here graphene growth on Ni films by using a rapid thermal annealing chemical vapor deposition set-up. The Ni film was annealed prior to graphene growth. It results in major Ni film surface grains with (111) preferred orientation after pre-growth annealing at 870°C, as confirmed by electron backscattered diffraction measurements (EBSD, Fig.1 a). A uniform and full layer graphene growth on the *in-situ* pre-annealed Ni films was achieved by controlling the deposition time, temperature, methane gas flow and, cooling rate. The as-produced graphene quality and number of layer was examined by scanning electron microscopy, Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). Further, the as-grown graphene was transferred to SiO_2/Si substrates by using a wet chemical transfer process with polymethyl methacralyte (PMMA) as a support layer. XPS and Raman measurements of the transferred graphene sample do not show the presence of PMMA residues or any metallic contamination (including Ni). Hall-effect measurements were performed on the graphene/SiO_2/Si sample using the Van Der Pauw geometry and showed p-type mobility 1200 $cm^2 V^{-1}s^{-1}$ and carrier concentration 3.9 10^{12} cm^{-2}. The as-grown and transferred large area good quality graphene represent an important step towards the fabrication of large-scale high-quality graphene

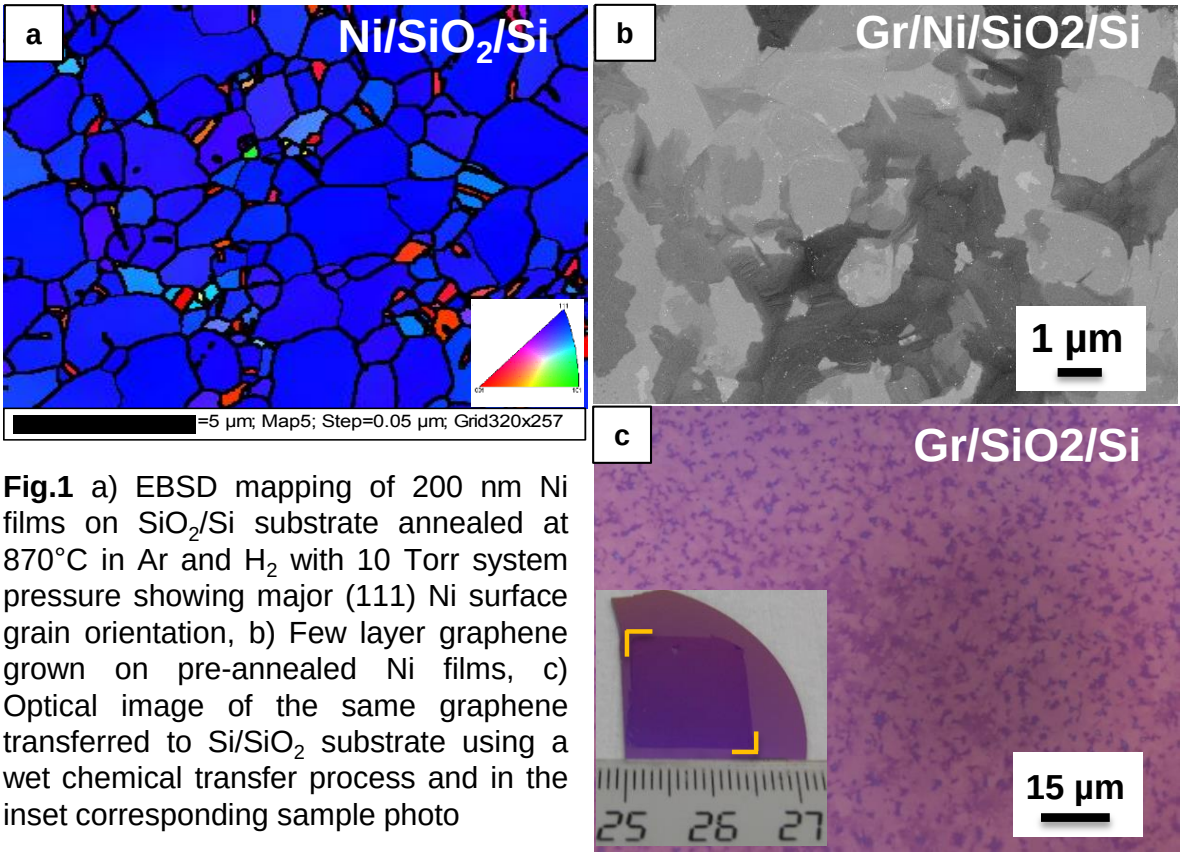

Fig.1 a) EBSD mapping of 200 nm Ni films on SiO_2/Si substrate annealed at 870°C in Ar and H_2 with 10 Torr system pressure showing major (111) Ni surface grain orientation, b) Few layer graphene grown on pre-annealed Ni films, c) Optical image of the same graphene transferred to Si/SiO_2 substrate using a wet chemical transfer process and in the inset corresponding sample photo