

Electron microscopy analysis on a few-layer graphene oxide modified with silicon.

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Graphene is an amazing material due to its exceptional properties such as its high electrical and thermal conductivity, extreme mechanical resistance, high intrinsic mobility, as well as many other outstanding properties. Recently, the insertion of heteroatoms in the carbon structure have been used in order to modify and enhance the graphene physical and chemical properties. Chemical vapor deposition (CVD) is one of the most promising, low cost and easily accessible method to synthesize graphene with reasonable quality on metal substrates such as Ni and Cu. In this work we investigated the growth of few layer graphene modified with silicon by combining the high resolution scanning electron microscopy and the high resolution transmission electron microscopy (HRTEM) with X-ray photoelectron spectroscopy (XPS) and Raman spectroscopy. Silicon doped graphene (Si-Gr) was grown on the Cu and Ni foils by the chemical vapor deposition method assisted by aerosol using toluene and ethanol as a carbon source, and triphenylsilane as a silicon dopant. The Si-Gr was deposited strategically on the copper grids for easy analysis. HRSEM in transmission and secondary electrons mode confirmed the uniformity of the graphene film with few layers (Fig. 1); also elemental composition was carried out on the graphene films using energy-dispersive x-ray spectroscopy (EDS). HRTEM images revealed that Si-Gr has more amorphous structure compared to pristine graphene (free doping) because of the intercalation of silicon in the hexagonal carbon network. According to the Raman results the doped graphene also showed major defect in the structure. In the same way, XPS elemental surface composition analysis showed a silicon content around of 0.81 at. % where the silicon is bonded to the carbon (Si-C). Finally, when examining the folded and rolled edged of graphene layers by HRTEM revealed that they are approximately three to six sheets of stacked graphene (Fig. 2).

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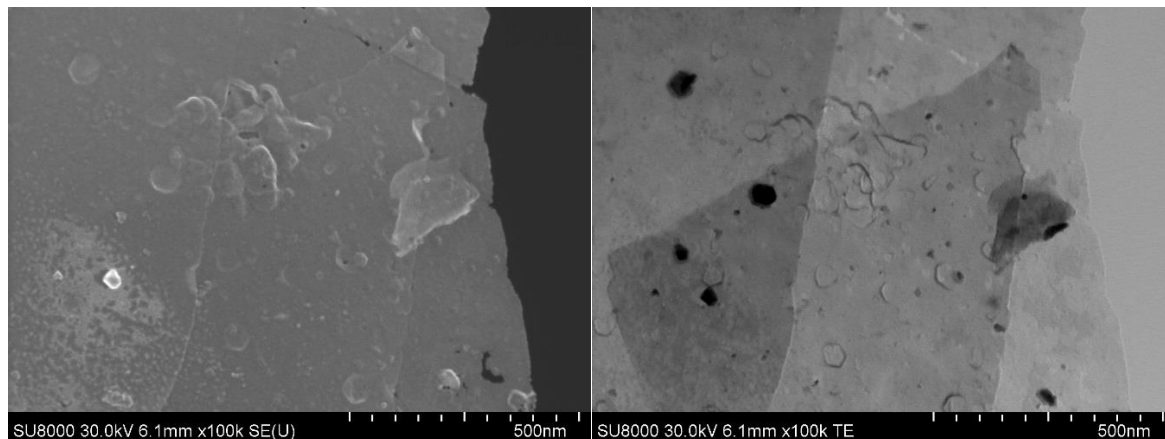


Fig. 1 Si-Gr Micrographs by HRSEM.

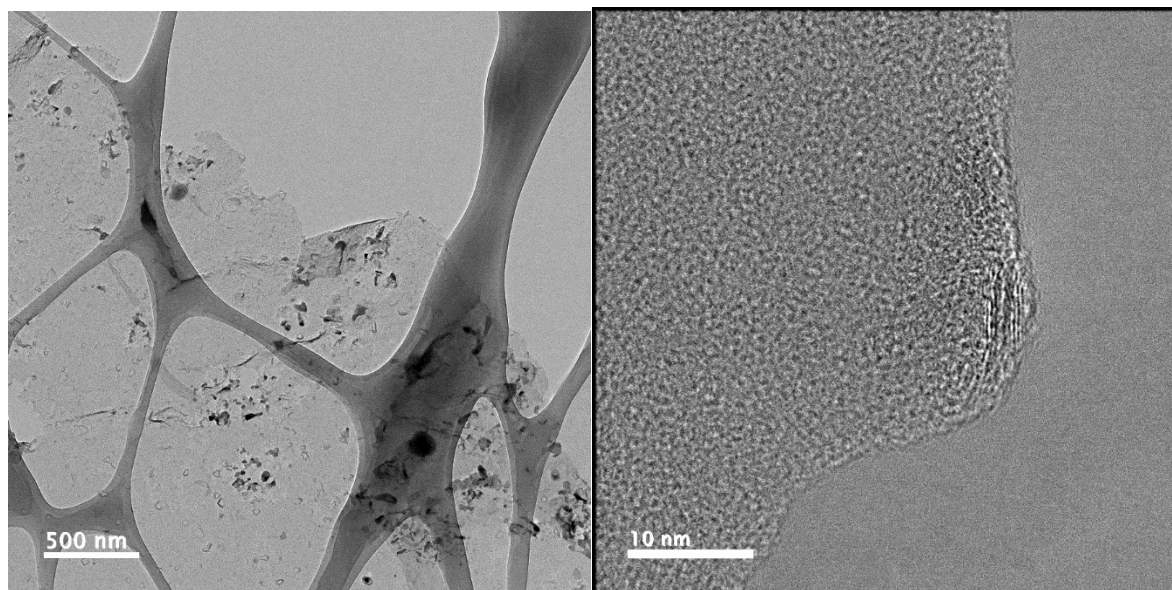


Fig. 2 Si-Gr Micrographs by HRTEM.