World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:02, 2019

Growth of Multi-Layered Graphene Using Organic Solvent-PMMA Film as the Carbon Source under Low Temperature Conditions

Authors : Alaa Y. Ali, Natalie P. Holmes, John Holdsworth, Warwick Belcher, Paul Dastoor, Xiaojing Zhou

Abstract : Multi-layered graphene has been produced under low temperature chemical vapour deposition (CVD) growth conditions by utilizing an organic solvent and polymer film source. Poly(methylmethacrylate) (PMMA) was dissolved in chlorobenzene solvent and used as a drop-cast film carbon source on a quartz slide. A source temperature (T_{source}) of 180 °C provided sufficient carbon to grow graphene, as identified by Raman spectroscopy, on clean copper foil catalytic surfaces. Systematic variation of hydrogen gas (H₂) flow rate from 25 standard cubic centimeters per minute (sccm) to 100 sccm and CVD temperature (T_{growth}) from 400 to 800 °C, yielded graphene films of varying quality as characterized by Raman spectroscopy. The optimal graphene growth parameters were found to occur with a hydrogen flow rate of 75 sccm sweeping the 180 °C source carbon past the Cu foil at 600 °C for 1 min. The deposition at 600 °C with a H₂ flow rate of 75 sccm yielded a 2D band peak with ~53.4 cm⁻¹ FWHM and a relative intensity ratio of the G to 2D bands (I_G/I_{2D}) of 0.21. This recipe fabricated a few layers of good quality graphene.

Keywords : graphene, chemical vapor deposition, carbon source, low temperature growth
Conference Title : ICGCS 2019 : International Conference on Graphene Chemistry and Structures
Conference Location : Dublin, Ireland
Conference Dates : February 14-15, 2019