Tuneable layers of Three Dimensional Graphene Structure Grown using Chemical Vapour Deposition

Norani Muti Mohamed, Mohamed Salleh Mohamed Saheed, Balbir Singh Mahinder Singh, Mohamed Shuaib Mohamed Saheed

[1]Centre of Innovative Nanostructures and Nanodevices (COINN),
[2]Department of Fundamental and Applied Sciences,
Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak Darul Ridzuan, Malaysia.
noranimuti_mohamed@petronas.com.my

Abstract

The interconnected 3D graphene structure was synthesized using chemical vapour deposition at atmospheric and low pressure (3 Torr) with different level of methane concentrations and using nickel foam catalyst. As shown in Figure 1, the hetero-epitaxial growth of graphene on Ni was well ordered indicating good agreement with carbon and nickel lattices. The presence of wrinkles and ripples was observed (Figure 1(b)) due to thermal expansion coefficients of both nickel and carbon [1]. Ni will expand at high temperature (1000^{o}C) and the dissociated carbon will be deposited in the form of multilayer graphene. Ni will then retracts when cool rapidly, thus pushing the graphene outwards forming wrinkles and ripples. The grown graphene were subjected to Raman analysis to determine the quality, dependence of G band and 2D band positions, intensities and shape with respect to different laser wavelengths (325 and 514 nm) [2, 3]. Figure 2 shows the G-band and 2D-band peaks at ~1580 cm^{-1} and 2700 cm^{-1}, respectively. The suppressed D-band peaks indicate the high crystallinity of the grown graphene. The shapes of 2D-band peaks indicate possible increase of the number of graphene layer from two to five with increase in vol% of CH_4.These layers-tunable graphene structure will be beneficial for applications such as supercapacitors.

References

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Figures

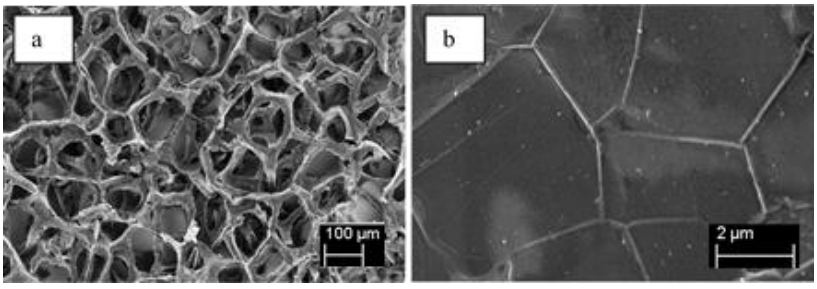

Fig 1: SEM image of a) interconnected 3D graphene, b) wrinkles and ripples on the surface.

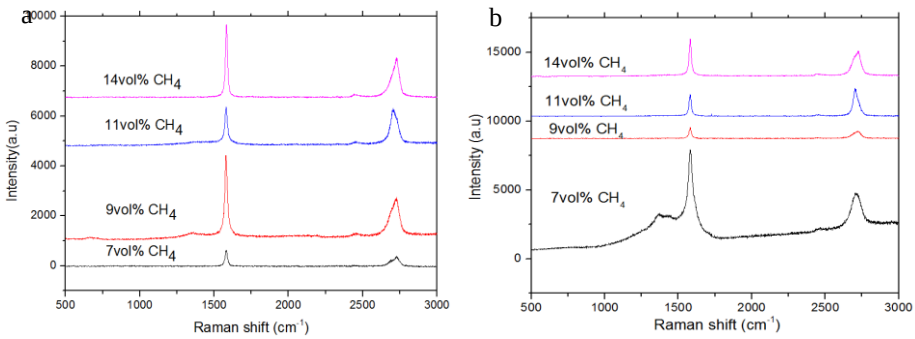

Fig 2: Raman spectrum for varying concentration of CH_4 at a) atmospheric pressure b) low pressure.