Effect of CO_2 and O_3 treatment on directly Synthesized Graphene on Insulating Substrates at low temperature using Microwave Plasma Enhanced Chemical Vapor Deposition

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Researchers are still in search of a better ways to synthesize graphene at lower temperatures directly on desired substrates to give an end to search of an alternative to Indium Tin Oxide (ITO) over a period of 20 years [1,2]. In this work, an attempted has been made to grow large area (2 x 2 cm) graphene directly on insulating substrates such as quartz, glass and SiO_2/Si using magnetron generated microwave plasma CVD at substrate temperature 300°C.

Key to this work is use of 0.3 sccm CO_2 during growth to put a control over vertical graphene growth generally forming carbon walls and 15-20 mins of O_3 treatment on as-synthesized graphene to improve sheet carrier mobility and transmittance (Fig.1). Optical microscope UV-Vis spectroscopy, Raman microscopy, X-ray Photoelectron spectroscopy (XPS), Scanning Electron Microscopy (SEM) and Atomic force microscopy (AFM) measurements confirmed the formation of 1.2nm thick continuous graphene layer on glass, quartz and SiO_2/Si with sheet resistance 1300Ω/□ and transmittance 80%. Although the formed graphene sheet resistance is near a kilo Ω/□ at the moment, the sheet resistance is reduced to 200 Ω/□ by doping process. This transfer free low-temperature synthesis approach is believed to explore new dimensions of graphene synthesis and applications[3].

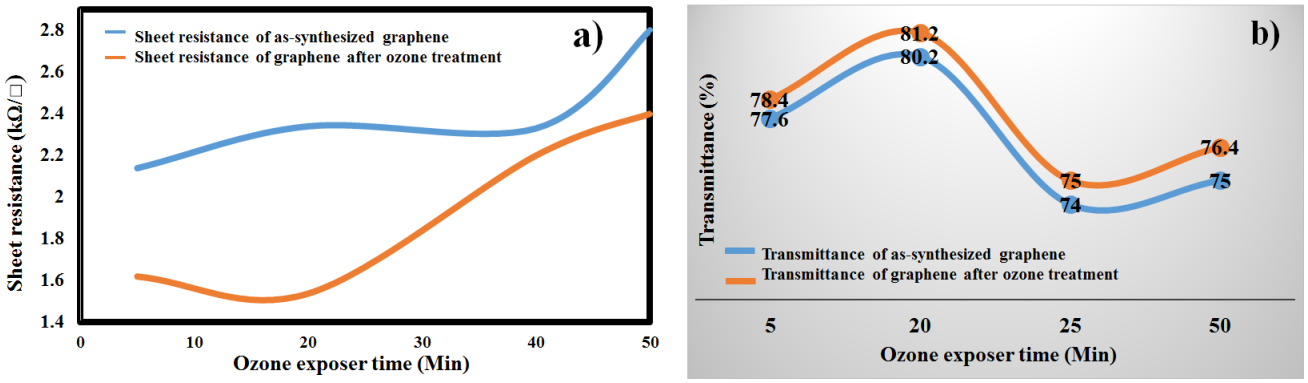

Fig. 1 Effect of Ozone treatment on a) sheet resistance and b) transmittance of PCVD synthesized graphene

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References

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