

100% Reproducibility and Improved Graphene Quality by Preheating Precursor Gases using Thermal Chemical Vapor Deposition

Gilbert Daniel Nessim, Miriam Somekh, Efrat Shawat Avraham

Laboratory for the synthesis of nanostructures
Department of chemistry and institute of nanotechnology at Bar Ilan University,
Ramat Gan, Israel
gdnessim@biu.ac.il

Abstract

By preheating the precursor gases (ethylene and hydrogen), we synthesized high-quality, few-layer graphene at reduced temperatures with full reproducibility on nickel thin films. Raman spectroscopy showed that the graphene films synthesized using gas preheating exhibited 50% less defects compared to those obtained without gas preheating.

All experiments performed using gas preheating were fully reproducible, while less than 15% of the experiments performed without gas preheating led to graphene of only acceptable quality. Gas chromatography/mass spectrometry (GC-MS) of the preheated gases showed an increased formation of polycyclic aromatic hydrocarbons (PAHs).

From these results, we postulated a new growth mechanism that fits previous density functional theory (DFT) reports of hydrocarbon stability on a nickel surface. The results presented are an important step in the direction of graphene synthesis at lower temperatures with full reproducibility. This work has been published in the Journal of Materials Chemistry A [1].

Reference

[1] M. Somekh, E. Shawat Avraham, G.D. Nessim, Journal of Materials Chemistry A, **Issue 36** (2-14) page 19750-19758.

Figures

