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.