

Ultrafast CVD growth graphene monolayer and single-crystal in cold-wall reactor

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Abstract

The method of high-quality graphene synthesis with a full cycle lasting less than 3 minutes, which is the fastest graphene synthesis cycle to date, is demonstrated in this work. The possibility of synthesizing graphene monolayers and single crystals up to 50 micrometres in size (see Figure 1) is demonstrated as well. To assess the quality of graphene, the most important criteria were selected: sheet resistance, charge mobility in a field effect transistor, Raman spectrum, film uniformity and graphene grain size. The key parameters for the synthesis of graphene are: the temperature of the copper foil, the concentration of the precursor and the synthesis time, as well as the rate of heating and cooling of the copper foil. The effect of these synthesis parameters on the quality of CVD-graphene is presented in this work. Graphene was synthesized by chemical vapor deposition in a cold-wall commercial reactor made by Rusgraphene LLC. The copper foil was heated by the resistive method, and methane was used as a precursor.

A distinctive feature of this equipment is the ability to quickly heat the foil in less than 1 minute and abrupt cooling of the foil. This makes it possible to more accurately control the synthesis of graphene on copper foil, namely, to heat the substrate in a short time and interrupt the synthesis at the moment when the graphene nuclei have grown sufficiently, but have not yet formed a single layer.

FIGURES

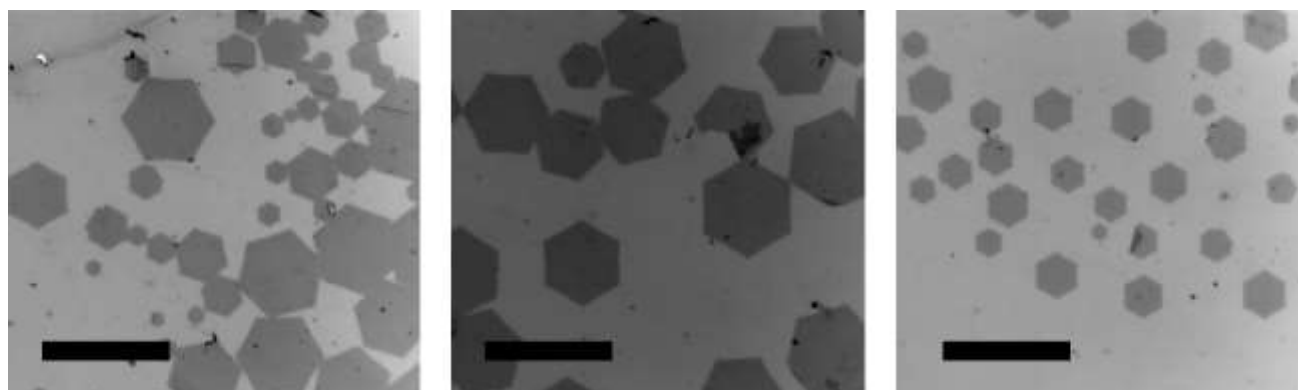


Figure 1: Optical images graphene single crystal. (All scale bar is 50 micrometres)