Chemical Vapor Deposition Growth of Graphene from Ethanol

Xiao Chen, Pei Zhao, Bo Hou, Erik Einarsson, Chiashi Shohei, Shigeo Maruyama

Department of Mechanical Engineering, The University of Tokyo, Tokyo 113-8656, Japan

chen@photon.t.u-tokyo.ac.jp

We present a systematic parameter study of graphene growth using chemical vapor deposition (CVD) on polycrystalline Cu foils from ethanol. The growth of high-quality graphene shows good reproducibility at CVD temperatures ranging from 800 °C to 950 °C, and at pressures lower than 100 Pa. We found that the higher the pressure of the ethanol vapor, the higher the likelihood of inhomogeneity and coexistence of single and multilayer graphene. With CVD pressure lower than 100 Pa, the formation rate of secondary graphene layer is well restrained, allowing sufficient time for complete coverage of single-layer graphene (Figure 1a). Higher temperatures (≥ 1000 °C) result in strong etching of the synthesized graphene layer (Figure 1b). Compared with the most commonly used carbon source, methane [1], ethanol as a precursor requires no hydrogen dilution, and consistently yields graphene of similar quality at 100-150 °C lower temperatures.

Figure 1. a) SEM images of graphene transferred onto Si/SiO₂ substrate after CVD durations of 5 s, 20 s, 40 s and 120 s. These samples were grown at 900 °C, 70 Pa. b) SEM image of graphene grown at 1000 °C on Cu. Scale bars are 3 μm.

Reference