

CVD synthesis of graphene from acetylene on copper foil

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Abstract

The challenges of graphene synthesis for its application at an industrial level are closely related to the synthesis of good quality material (good electrical properties and stability) and the ability to transfer it onto large areas without changing its physical properties. The study involves methods of synthesis that have been recently developed and which can be properly scaled to an industrial level, such as is the case of chemical vapor deposition (CVD)

CVD synthesis is both simple and inexpensive. It allows the production of graphene over large areas. It involves the decomposition of gaseous hydrocarbons (CH₄, C₂H₂, CH₃OH, among others) at elevated temperature. The metallic substrate acts as a catalyst for the decomposition reaction leaving carbon on the surface. However, it has been difficult to control the number of grown graphene layers. In recent years there has been extensive use of Cu as a catalyst, because it provides a better control of the number of graphene layers, which in turn is directly related to the low solubility of carbon in copper [1,2].

The growth of graphene onto copper foil substrates by CVD was employed. The gases applied in the synthesis were acetylene as a carbon source and hydrogen. Both for 20min growth time at 1000°C and low pressure.

In the experiments, during the growth process, the acetylene flux is stays constant, while the hydrogen flow varied during the first 5 minutes of synthesis. Raman spectroscopy ($\lambda = 532 \text{ nm}$) shows that a bilayer of graphene was obtained in all tests. However for the 5min/60+15min/120 hydrogen flux process, a better quality bilayer was obtained, **Figure 1**.

References

[1] M. H. Rummeli, A. Bachmatiuk, A. Scott, F. Börrnert, J. H. Warner, V. Hoffman et al. ACS Nano, **4** (2010) 4206-4210.

[2] J. Hofrichter, B. N. Szafranek, M. Otto, T. J. Echtermeyer, M. Baus, A. Majerus et al. Nano Lett., **10** (2010) 36-42.

Figure

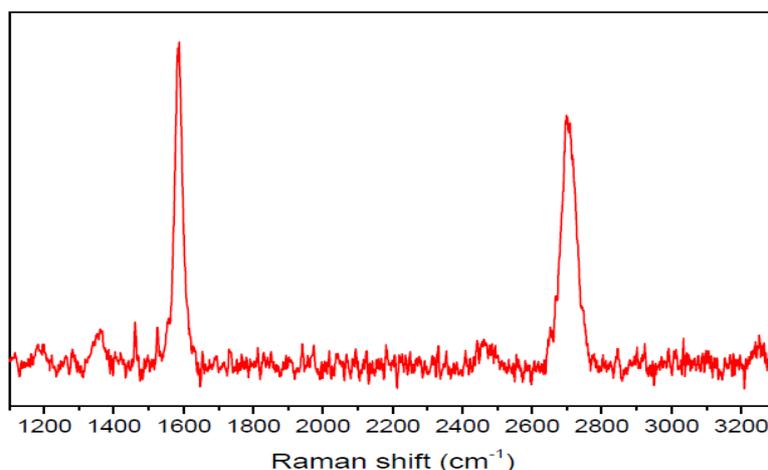


Figure 1. Raman spectra of bilayer graphene synthesized by CVD process.