Optimization of CVD Growth Graphene on Nickel using Taguchi Method

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Abstract

The chemical vapor deposition (CVD) is a fairly available method for the synthesis of large area graphene films with high quality for industrial applications [1]. Transition metals including Ni, Cu, Pt, Ir and Pd have been used as a substrate for graphene growth [2]. Among them, nickel is a well-known transition metal as a substrates for graphene growth, due to the high carbon solubility and low lattice mismatch with graphene [3].

In CVD method, where variables of parameters, such as temperature, gas flow rate and pressure are involved [3], since many experiments need to be performed for reaching at the optimum conditions. The Taguchi method, which is a combination of mathematical and statistical analyzing system to optimize synthetic processes of nanostructured materials [4-5]

In this work, Taguchi method is applied to the optimization of the synthesis of graphene by nickel catalyzed chemical vapor deposition (CVD) with the aim of high transparency and low sheet resistance of the growth process. Three parameters, growth temperature (X_1: 800-900 ^{o}C), concentration of CH_4 (X_2: %5-%50), and growth time (X_3: 2-10 min.) are optimized using a 3-level Taguchi design. The characterization of graphene films are made by Raman spectroscopy, optical transmittance and sheet resistance after they were transferred on glass slides.

References

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