CVD Graphene Growth Mechanism on Nickel Thin Films

K. Al-shurman[1], H. Naseem [2]

[1]The Institute for Nanoscience & Engineering, University of Arkansas, Fayetteville, AR, USA
[2]Department of Electrical Engineering, University of Arkansas, Fayetteville, AR, USA

Abstract

Graphene is one of the most recent carbon nanomaterials that attracted widespread attention because of its superior properties and enormous potential for various applications. Currently, Chemical vapor deposition is considered a promising method for synthesis of graphene films on different types of substrate utilizing transition metals such as Ni. However, synthesizing a single-layer graphene and controlling the quality of the CVD graphene film on Ni are very challenging due to the multiplicity of the CVD growth conditions. Therefore, computer modeling could be supportive in understanding CVD graphene growth mechanism on Ni thin film. COMSOL Multiphysics® software is used to investigate the CVD graphene growth on Ni film. Factors affecting CVD graphene synthesis include carbon solubility in Ni, growth time, growth temperature, cooling rate, as well as Ni film thickness. Our COMSOL model uses transport of diluted species as well as heat transfer in Ni thin film. In this particular research, the number of the simulated graphene layers on Ni film is compared with experimental data. Also, the effect of many parameters on graphene film fabrication is stated. The geometry of the model is shown in Figure 1, highlighting the physics parameters used in the simulation. Also, Figure 2 shows an example of the effect of the Ni film cooling to room temperature on the number of graphene layers formed on the nickel film surface.

Figures used in the abstract

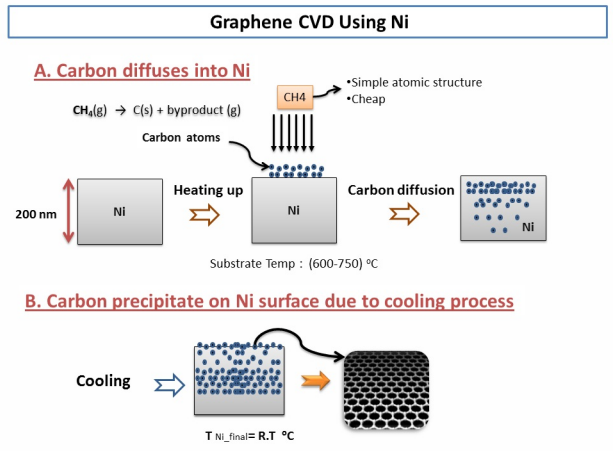

Figure 1: CVD graphene growth mechanism on nickel thin films.

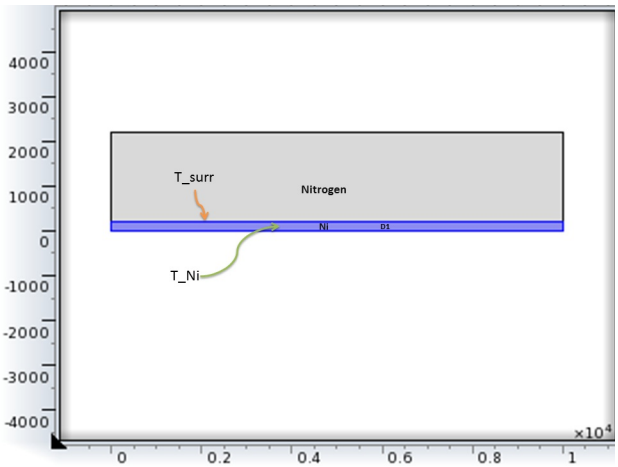

Figure 2: The geometry of the model.

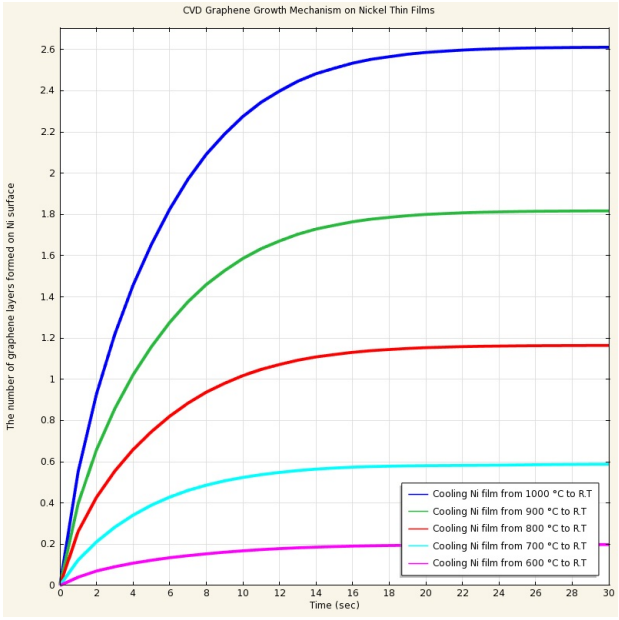

Figure 3: The number of graphene layers formed on the Ni film vs. time.