COMSOL Multiphysics® Simulations of Graphene Chemical Vapor Deposition (CVD) Growth

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Abstract

Graphene has recently become one of the hottest area for researchers in many different fields due to its amazing properties and potential applications in monolithic integrated circuit fabrication. Presently, chemical vapor deposition (CVD) is a promising effective method for synthesis of graphene films. CVD graphene film is obtained from hydrocarbon species such as CH4 through complex chemical reactions. Therefore, studying the reaction kinetics is essential process for understanding the thermal decomposition rate of methane as well as the reaction mechanism. In this study, COMSOL Multiphysics® is used to investigate graphene chemical vapor deposition process. Our COMSOL model uses Chemical Reaction Engineering Module, a Laminar Flow interface, and Heat Transfer Module. The module simulates the methane decomposition reactions encountered in the CVD chamber and shows the accumulated growth height of the graphene film as a function of time and space. As a result of the simulated carbon deposition process, the final thickness of the deposited graphene film is 3.5668 Å which is equal to the thickness of monolayer of graphene. Figure 1 illustrates the geometry of the model. Furthermore, Figure 2 shows the final height of deposited graphene film.

Figures used in the abstract

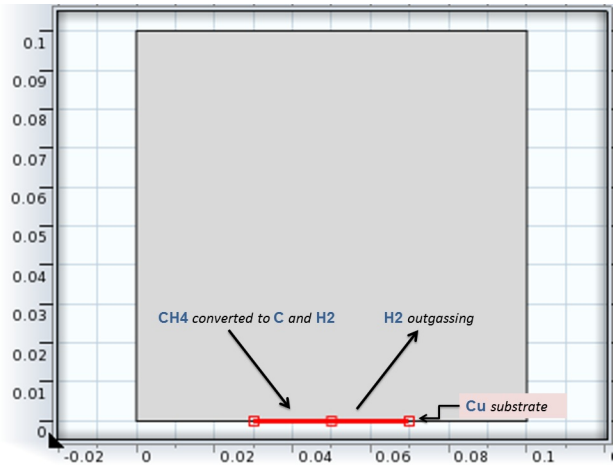

Figure 1: Geometry and basic conducting principle for graphene CVD deposition.

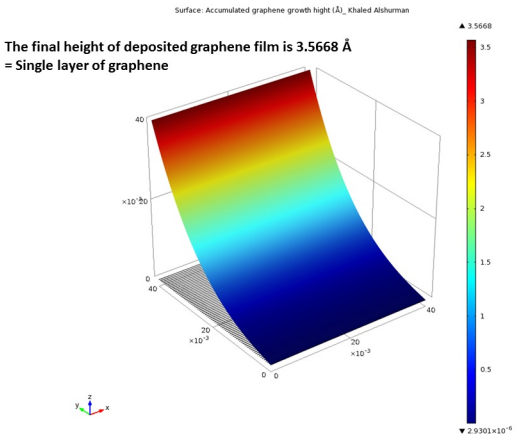

Figure 2: The growth height (surface and z-axis) vs. the substrate arc length (x-axis) and time (y-axis). The final height of deposited graphene is 3.5668 Å.