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Study thickness uniformity, wrinkling and effect of ambient conditions in epitaxial Graphene grown on SiC polytypes

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Abstract

Graphene growth was performed on 4H-SiC(0001), 6H-SiC(0001), and 3C-SiC(111) substrates in argon atmosphere at 2000°C. Grown graphene was assessed by AFM, LEEM, ARPS, STM, and STS.

Graphene formation and its thickness uniformity have been analyzed in respect to step bunching and surface decomposition energy differences on different SiC polytypes. The uniformity of silicon sublimation is an important factor for obtaining large area homogenous graphene. We have demonstrated a monolayer (ML) graphene growth on all SiC polytypes, but larger area, over 50×50 μm^2, on 3C-SiC substrates. 6H-SiC shows close quality of graphene to that on the 3C-SiC, because half of the unit cell contains three Si-C bilayers. The results on 4H-SiC show that graphene formation process has narrower window of growth parameters.

Graphene wrinkles easily, by compressive strain due to the thermal mismatch of graphene and SiC induced during sample cooling. Wrinkles are linear defects which can cause carrier scattering and decrease mobility. Deep understanding and control of wrinkle appearance are central to our current research. By modifying substrate conditions we have been able to change the wrinkle orientation from a random network to a full alignment in a particular direction or radial. We will present effect of thermal cycling, cooling down to 4 K, and ambient conditions on graphene layer and wrinkles. Adsorption of ambience species was observed to be more pronounced on a ML graphene. Wrinkling was studied in a series of computer simulation with the molecular dynamic method using AIREBO forcefield and Tersoff potential.

Biography

Gholamreza Yazdi has completed his Ph.D (Title. Growth and characterization of AlN-from Nano structure to bulk material) in 2008 at Linkoping University. He is now working as assistant professor at this University. His research focuses on growth and characterization of graphene on SiC. He has about 30 papers and recently one of his papers on graphene field accepted in journal of Carbon.