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Structural effect of Ni-Cu catalysts for graphene growth by pulsed laser deposition

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Abstract

Pulsed laser deposition was applied to grow few-layers graphene from highly oriented pyloric graphite target on different types of nickel (Ni)-copper (Cu) substrates. The substrates were prepared with two different structures; alloy and composite with different concentration ratios of Ni-Cu bi-metals. X ray diffraction and side view field emission scanning electron microscopy were utilized to analyze and verify the two structures. The catalytic effect of both substrates on graphene growth was studied at different growth temperatures using Raman spectroscopy. The experimental findings yielded unexpected catalytic effect discrepancies of composite than alloy substrates. The composite substrates proved excellent growth ability for unique 2-dimensional (2D) graphene layers over wide range of temperatures, while highly defected graphene was grown on alloy substrates with an appropriate Ni to Cu ratio. Structure of the composite substrates could impose a specific interaction on their surface that enhance the formation of 2D layers. The results suggest a class of highly efficient metallic catalyst for few-layer graphene growth via two steps segregation process and open fundamental insights in understanding graphene growth on complex substrates.

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