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A morphology study on the epitaxial growth of graphene and its buffer layer

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Abstract

We investigate the epitaxial growth of the graphene buffer layer and the involved step bunching behavior of the silicon carbide substrate surface using atomic force microscopy. The results clearly show that the key to controlling step bunching is the spatial distribution of nucleating buffer layer domains during the high-temperature graphene growth process. Undesirably high step edges are the result of local buffer layer formation whereas a smooth SiC surface is maintained in the case of uniform buffer layer nucleation. The presented polymer-assisted sublimation growth method is perfectly suited to obtain homogenous buffer layer nucleation and to conserve ultra-flat surfaces during graphene growth on a large variety of silicon carbide substrate surfaces. The analysis of the experimental results is in excellent agreement with the predictions of a general model of step dynamics. Different growth modes are described which extend the current understanding of epitaxial graphene growth by emphasizing the importance of buffer layer nucleation and critical mass transport processes.

Keywords: epitaxial graphene, buffer layer, polymer-assisted sublimation growth (PASG), step bunching behavior, step height control, hydrogen etching, silicon carbide (SiC)

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