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The role of carbon surface diffusion on the growth of epitaxial graphene on SiC TAISUKE OHTA, NORMAN BARTELT, SHU NIE, KONRAD THUERMER, GARY KELLOGG, Sandia National Laboratories — Growth of high quality graphene films on SiC is regarded as one of the more viable pathways toward graphene-based electronics. Graphitic films form on SiC at elevated temperature because of preferential sublimation of Si. Little is known, however, about the atomistic processes of interrelated SiC decomposition and graphene growth. We have observed the formation of graphene on SiC by Si sublimation in an Ar atmosphere using low energy electron microscopy, scanning tunneling microcopy and atomic force microscopy. This work reveals that the growth mechanism depends strongly on the initial surface morphology, and that carbon diffusion governs the spatial relationship between SiC decomposition and graphene growth. Isolated bilayer SiC steps generate narrow ribbons of graphene, whereas triple bilayer steps allow large graphene sheets to grow by step flow. We demonstrate how graphene quality can be improved by controlling the initial surface morphology specifically by avoiding the instabilities inherent in diffusion-limited growth. This work is supported by the LDRD program at Sandia Labs, and the US DOE Office of Basic Energy Sciences, Division of Materials Science and Engineering (DE-AC04-94AL85000), and was performed in part at CINT (DE-AC04-94AL85000).

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