

Abstract Submitted
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The origin of incommensurate and commensurate phases of graphene interacting with SiC(0001)¹ MATTHEW CONRAD, ANNA MIETTINEN, Georgia Inst of Tech, JULIEN RAULT, JEAN-PASCAL RUEFF, YVES GARREAU, ALINA VLAD, ALESSANDRO COATI, Synchrotron SOLEIL, PAUL MICELI, Univ Missouri, EDWARD CONRAD, Georgia Inst of Tech — Recently, the properties of the first graphene layer grown on SiC(0001), commonly called the buffer layer, have surprised the research community. We show that this layer is incommensurate with the SiC substrate despite 40 years of assuming that it was commensurate. The incommensurate phase explains why the buffer is semiconducting. In this work, we go on to show that previous notions that the buffer layer structure is independent of the number of graphene layers grown above it also incorrect. Both the physical and electronic structure of the buffer depends on growth conditions and coverage. At this stage, it is unclear why the system is incommensurate and why it undergoes an incommensurate to commensurate phase transition when a graphene monolayer forms above it. These important issues are addressed through a complementary study of X-ray Standing Wave photoemission spectroscopy and surface x-ray reflectivity. We gain detailed information regarding the vertical interface structure and atomic concentration of buffer and monolayer graphene. We find substantial differences in interface structure of the two systems that provide new insights of the nature of the incommensurate and commensurate phases of the SiC-graphene interaction.

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