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CVD growth of single-crystal monolayer graphene on H-terminated germanium surface

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Large-area graphene has been grown by catalytic chemical vapor deposition (CVD) on various metal substrates. However, the uniform growth of single-crystal graphene over wafer-scale areas remains a challenge toward the commercial realization of various electronic, photonic, mechanical, and other devices based upon the outstanding properties of graphene. In this talk, we present the growth of single-crystal monolayer graphene on hydrogen-terminated germanium (Ge) surface. A single-crystal Ge substrate is a promising candidate for the growth of single-crystal graphene, because of (i) its catalytic activity for the catalytic decomposition of the formation of graphitic carbon on the surface; (ii) the extremely low solubility of carbon in Ge even at its melting temperature, enabling growth of complete monolayer graphene; (iii) the anisotropic atomic arrangement of single crystal Ge surface, enabling aligned growth of multiple seeds; (iv) the availability of a large area single-crystal surface via epitaxial Ge growth on Si wafers. We observed that well-defined atomic arrangement on the single crystal Ge surface enabled aligned growth of multiple seeds which can merge to single crystal graphene. Furthermore very weak van der Waals interaction between graphene and underlying Ge surface enabled facile dry transfer of graphene and recycling the Ge/Si wafer for continuing growth.