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Scanning tunneling microscopy studies of graphene and hydrogenated graphene on Cu(111)[1] SHAWNA M. HOLLEN, GRADY GAMBREL, STEVEN TJUNG, NANCY M. SANTAGATA, EZEKIEL JOHNSTON-HALPERIN, JAY A. GUPTA, The Ohio State University — Because of the innate sensitivity of 2D material surfaces, it is increasingly important to understand and characterize surface functionalization and interactions with environmental elements, such as substrate, metallic contacts, and adatoms. We developed a method for reproducible, epitaxial growth of pristine graphene islands on Cu(111) in UHV and use scanning tunneling microscopy and spectroscopy (STM) to study the interaction of these graphene islands with the Cu substrate. Tunneling spectroscopy measurements of the electronic surface states over the graphene islands indicate a lower local work function, decreased coupling to bulk Cu states, and a decreased electron effective mass. Additionally, we developed a novel field electron dissociation technique to form hydrogen-terminated graphene at low temperatures and in UHV. This method produced what may be the first STM images of crystalline hydrogenated graphene. The pristine graphene island is then recovered by scanning at a high tip-sample bias. The hydrogenation and its reversibility suggest writing lateral 2D devices using the STM tip. Toward this end, we are developing the capability to repeat the hydrogenation on working graphene devices.

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