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Controlled electrochemical functionalization of epitaxial graphene[1] CALVIN CHAN, THOMAS BEECHEM, TAISUKE OHTA, DAVID WHEELER, Sandia National Laboratories, KEITH STEVENSON, University of Texas, Austin — Chemical functionalization is a promising means of modifying graphene for applications ranging from nanoelectronics to transparent electrodes. Various schemes have been demonstrated, but control over functionalization density with well-specified molecules is still a challenge. We report on the controlled electrochemical functionalization of epitaxial graphene with trifluoromethylphenylene (CF_3Ph), where the functionalization density was controlled by the electron injection rate. CF_3Ph peaks were observed in x-ray photoemission spectroscopy, along with binding energy shifts consistent with bonding between CF_3Ph and graphene. A maximum functionalization density of one molecule per six graphene carbons was inferred from the peak intensities. Spectroscopic Raman mapping revealed increasing graphene D:G peak intensity ratios that scaled with increasing functionalization-induced localized defects. While a minimal shift in the π orbital structure and the emergence of CF_3Ph related features were observed in ultraviolet photoemission spectroscopy, a work function increase by 0.5 eV in CF_3Ph-graphene suggests a shift of the electron distribution towards the CF_3 moieties on the surface. This work has positive implications for transparent electrode applications.

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Calvin Chan
Sandia National Laboratories

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