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Atomtronics: The Application of Organometallic Bis-Hexahapto Bonding to the Electrical Interconnection and Electronic Conjugation of the Graphitic Surfaces of Carbon Nanotubes and Graphene

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We have demonstrated the functionalization of epitaxial graphene with nitrophenyl groups and by the application of the Kobe reaction. The chemical formation of covalent carbon-carbon bonds involving the basal plane carbon atoms offers an alternative approach to the control of the electronic properties of graphene; the transformation of the carbon centers from sp^2 to sp^3 introduces a barrier to electron flow by saturating the carbon atoms and opening a band gap which potentially allows the generation of insulating, semiconducting and magnetic regions in graphene wafers.[1] This raises the question of the role of covalent bonding in the interconnection of graphitic surfaces and the prospects for the use of such bonds in electronically conjugating neighboring carbon nanotube and graphene surfaces without saturating and destructively rehybridizing the carbon atoms at the point of attachment while simultaneously maintaining the band structures of the intact benzenoid nanostructures. In this talk I will discuss our recent results on the covalent modification of the electronic structure and properties of graphene, and the application of organometallic chemistry to facilitate the interconnection of single-walled carbon nanotubes and to increase the dimensionality of graphitic surfaces. 1. Bekyarova, E.; Sarkar, S.; Wang, F.; Itkis, M. E.; Kalinina, I.; Tian, X.; Haddon, R. C., Effect of Covalent Chemistry on the Electronic Structure and Properties of Carbon Nanotubes and Graphene. Acc. Chem. Res. 2013, 46.