Quantum Hall Effect observed for covalently and non-covalently functionalized epitaxial graphene*

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We demonstrate no deterioration of electrical properties for epitaxial graphene, formed on SiC substrates via Si sublimation at elevated temperatures, functionalized using both covalent and non-covalent chemical approaches. In particular, we show that these functionalized samples exhibit the Quantum Hall Effect and possess Shubnikov-de Haas oscillations, which are typical for high quality exfoliated graphene flakes. We did not observe these phenomena on the initial pristine epitaxial graphene films. From first principle calculations, these results are likely due to reduced sheet charge density after functionalization, derived from charge transfer from the chemical molecules to the epitaxial graphene that shift the Fermi level closer to the charge neutrality point. This mechanism is supported by experimental data. This means that using our approach, and through the appropriate choice of functionalization moieties, the Fermi level of graphene can be controlled without detriment to electrical properties.

* This work was supported by NRL Base Program.