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Stage-1 intercalation compounds of few graphene layers by anhydrous ferric chloride PINGHENG TAN, WEIJIE ZHAO, JIAN LIU, SKLSM, Institute of Semiconductors, Chinese Academy of Sciences, Beijing 100083, PR China, ANDREA FERRARI, Engineering Department, University of Cambridge, Cambridge CB3 0FA,UK — Anhydrous ferric chloride (FeCl3) was used to intercalate few graphene layers into stage-1 intercalation compounds. The intercalant, staging, stability, and doping of the resulting intercalation compounds are characterized by Raman scattering. The G peak of pure stage-1 compounds upshifts to ∼1626 cm-1, which is similar to that of heavily-doped monolayer graphenes by 18M sulfuric acid. A single Lorentzian line shape for the 2D band of stage-1 compounds were observed, which indicates that each layer behaves as a decoupled heavily doped monolayer. By performing Raman measurements at different excitation energies, we show that, for a given doping level, the variation of the 2D intensity relative to the G peak with excitation energy allows one to assess the Fermi energy. This allows us to estimate a Fermi level shift of up to ∼0.85 eV, which agrees well with that estimated from the 2D/G intensity ratio and is close to ∼0.9 eV measured in stage-1 GICs by electron energy loss spectroscopy. The stage-1 intercalation compound of few graphene layers is thus ideal test-beds for the physical and chemical properties of heavily doped graphenes.

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