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Nano-patterning of fluorinated graphene by electron beam SAVERIO RUSSO, FREDDIE WITHERS, THOMAS BOINTON, Centre for Graphene Science, University of Exeter, Exeter, United Kingdom, MARC DUBOIS, Clermont Université, UBP, Laboratoire des Matériaux Inorganiques, Aubiére, France, MONICA CRACIUN, Centre for Graphene Science, University of Exeter, Exeter, United Kingdom — The development of transparent electronics is reliant on achieving high conductivity materials with a gate tuneable carrier mobility and low contact resistance at the interface with metals. Graphene –a layer of carbon atoms in a honeycomb lattice- offers just such a possibility. Functionalizing graphene with fluorine induces the opening of a band gap in the otherwise semimetallic graphene. Here we demonstrate that fluorinated graphene –a wide gap semiconductor with sp3 electron orbital hybridization- can be selectively reduced to graphene by electron-beam irradiation. We employ this functionality to pattern conductive nanostructures in a sheet of fluorinated graphene, realizing transparent graphene-based electronic devices such as nanoribbons without the need for etching of graphene. Electrical transport experiments over a wide range of temperatures (from 300K to 4K) of the ribbons show a transport gap whose size is inversely proportional to the width of the patterned ribbons. In this gap, electrons are localized, and charge transport is dominated by variable range hopping. Charging effects constitute a significant portion of the activation energy, and we find that the activation energy scales well with the width of the ribbons [Nano Lett. 11, 3912 (2011)].

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