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Polymer coating and stress test for carrier density stabilization in epitaxial graphene ALBERT RIGOSI, CHIEH-I LIU, YANFEI YANG, JAN OBRZUT, HSIN YEN LEE, EMILY BITTLE, RANDOLPH ELMQUIST, National Institute of Standards and Technology — Homogeneous monolayer epitaxial graphene (EG) is an ideal candidate for the development of a quantum Hall resistance (QHR) standard. A clean fabrication process was used to produce EG-QHR devices with a n-type doping level of order 10^{11} cm^{-2}, which delivers the metrological accuracy at the ν =2 plateau in a moderate magnetic field (<9 T). However, the ν =2 plateau deviates from h/2e^2 quickly as the carrier density shifts close to the Dirac point (<10^{10} cm^{-2}), and this observation occurs over time as EG is exposed to air, allowing for complexation with p-type molecular dopants. Here we report experimental results on the use of parylene C as an encapsulation layer, whereby EG can maintain its carrier density level under ambient laboratory conditions for a few months. Furthermore, we varied the parylene C thicknesses and the controllable temperatures (up to 85C) and humidities (up to 85%). We monitored the electronic properties of our EG samples by low temperature magnetotransport measurements in a 9 T superconducting magnet cryostat, and room temperature surface conductance in a resonant microwave cavity. We will compare parylene C, Cytop, and PMMA and show that polymer encapsulation may offer a solution to the problem of carrier density instability from atmospheric doping.

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