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Data Article

Quantum Hall device data monitoring following encapsulating polymer deposition

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ABSTRACT

The information provided in this data article will cover the growth parameters for monolayer, epitaxial graphene, as well as how to verify the layer homogeneity by confocal laser scanning and optical microscopy. The characterization of the subsequently fabricated quantum Hall device is shown for example cases during a series of environmental exposures. Quantum Hall data acquired from a CYTOP encapsulation is also provided. Data from Raman spectroscopy, atomic force microscopy, and other electrical property trends are shown. Lastly, quantum Hall effect data are presented from devices with deposited Parylene C films measuring 10.7 μm and 720 nm. All data are relevant for Rigosi et al. [1].

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Specifications table

Subject area	*Physics*
More specific subject area	*Condensed Matter, Quantum Hall Effect*
Type of data	*Table, images, graphs*
How data was acquired	*Confocal laser scanning microscope [Olympus LEXT OLS4100], optical microscope [Nikon MM400, DS Ri2 Camera], Janis Research cryostat and magnet system [model 8TM-TLSL-HE3–17], atomic force microscope [Asylum Cypher], Raman spectroscopy [Renishaw InVia]*
Data format	*Raw data is graphed*
Experimental factors	*Parylene and CYTOP deposition*
Experimental features	*Monitor quantum Hall effect parameters after environmental exposures*
Data source location	*National Institute of Standards and Technology (U.S. Department of Commerce), 100 Bureau Drive, Gaithersburg, MD 20899*
Data accessibility	*Data is with this article*
Related research article	*Albert F. Rigosi, Chieh-I Liu, Bi Yi Wu, Hsin-Yen Lee, Mattias Kruskopf, Yanfei Yang, Heather M. Hill, Jiuning Hu, Emily G. Bittle, Jan Obrzut, Angela R. Hight Walker, Randolph E. Elmquist, and David B. Newell. Examining epitaxial graphene surface conductance and quantum Hall device stability with Parylene passivation. Microelectronic Engineering (in press).*

Value of the data

- The data provided in this submission can be used to help other researchers gauge the level of electrical stability needed for a variety of two-dimensional materials, especially those whose properties may drift with time due to atmospheric doping.
- These data can serve as a guide to further research in Parylene encapsulation.
- Those conducting research with epitaxial graphene can use the images, AFM, and Raman provided as a reference guide to identifying the correct number of the grown graphitic layers and for layer numbers in other van der Waals materials.

1. Data

1.1. Characterization of epitaxial graphene quantum Hall devices

After the growth and verification procedures described in the methods section, epitaxial graphene (EG) are fabricated into quantum Hall devices and characterized with a Janis Research cryostat and magnet system (model 8TM-TLSL-HE3–17).[a] Four relevant quantum Hall parameters are the Hall resistance (R_{xy}), electron density (n_e), mobility (μ), and longitudinal resistivity (ρ_{xx}), and they are all measured and calculated ($n_e = \frac{1}{e\left(\frac{dR_{xy}}{dB}\right)}$ and $\mu = \frac{1}{en_eR_{xx}\frac{W}{L}}$, where W and L are the width and length of the Hall device, respectively) as a function of up to nine process steps described in detail in Reference [1]. An example of how these parameters are monitored is shown in Fig. 1. The three example process steps are listed as such: A measurement on the four parameters is collected, followed by an exposure to a 60 °C and 85% relative humidity environment (using a Thermotron[a] environmental chamber), measurement collected, a repeated exposure to 60 °C and 85% relative humidity, measurement collected, and storage in air for two weeks, followed by a final measurement.