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Hierarchy of Electronic Properties of Chemically Derived and Pristine Graphene Probed by Microwave Imaging WORASOM KUNDHIKANJANA, KEJI LAI, Geballe Laboratory for Advanced Materials, Stanford University, HAILIANG WANG, HONGJIE DAI, Department of Chemistry, Stanford University, MICHAEL KELLY, ZHI-XUN SHEN, Geballe Laboratory for Advanced Materials, Stanford University — AFM-compatible near-field microwave impedance microscope (MIM), capable of measuring local complex dielectric constant with 100 nm resolution, is used to study graphene in different modalities, with a hierarchy of electrical properties. The low-conductivity graphite oxide and its derivatives show significant electronic inhomogeneity. In the low DC resistance chemically exfoliated graphene sheets, the residual defects lead to appreciable electronics inhomogeneity. In contrast, the signals from pristine graphene are homogenous over the whole pieces. MIM provides an effective way to conduct a statistical study on many graphene pieces without requiring any contact electrode. When plotted as a function of the sheet areas, the signals from the pristine graphene agree well with a lumped-element circuit model, as expected for good conductors, while the signals from the chemical graphene systematically fall below the expected curve. The local impedance can also be used to verify the electrical contact between overlapped graphene pieces – critical information but difficult to obtain by other methods.

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