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Characterization of the plasmon mode of graphene/$LaAlO_3$/$SrTiO_3$ system WEITAO DAI, Department of Physics, West Virginia University, Morgantown, West Virginia 26506, SANGWOO RYU, CHANG-BEOM EOM, Department of Materials Science and Engineering, University of Wisconsin-Madison, Madison, Wisconsin 53706, CHENG CEN, Department of Physics, West Virginia University, Morgantown, West Virginia 26506 — Engineering graphene's properties in nanoscale with minimum material degradation is an outstanding challenge in graphene based technologies. Here we present a method targeting at on-demand tuning of 2D plasmon in graphene based on the integration of graphene and a novel complex oxide heterostructure. The recent development of complex oxides has raised the prospect for new classes of electronic devices. In particular, researchers have discovered a high-mobility two-dimensional electron gas forming at the interface between $LaAlO_3$ (LAO) and $SrTiO_3$ (STO). More interestingly, in samples with 3-unit-cell LAO film grown on STO substrate, a biased conducting atomic force microscope probe can locally and reversibly controls the interfacial metal-insulator transition. The close coupling of graphene with these programmable interfacial nanostructures in graphene/LAO/STO heterostructures presents numerous device opportunities. Samples with contacts addressing graphene and oxide interface separately are fabricated. Transport experiments are performed to study the carrier coupling in such hybrid bilayer conducting system. We also report the investigation of plasmonic properties using a variable temperature near field scanning optical microscope.

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