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Infrared nano-imaging and nano-spectroscopy of surface plasmons in bilayer graphene ZHE FEI, ERIC G. IWINSKI, University of California, San Diego, ALESANDR S. RODIN, Boston University, MARTIN WAGNER, MENGKUN LIU, SIYUAN DAI, MICHAEL D. GOLDFLAM, University of California, San Diego, WENZHONG BAO, University of Maryland at College Park, YONGJIN LEE, CHUN NING LAU, University of California, Riverside, FRITZ KAILMANN, Ludwig-Maximilians-Universität München, ANTONIO H. CASTRO-NETO, National University of Singapore, LINGFENG M. ZHANG, MICHAEL M. FOGLER, DIMITRI N. BASOV, University of California, San Diego — Bernal stacking bilayer graphene (BLG) has demonstrated its capability for application in a wide range of fields including electronics, photonics and energy engineering. So far, plasmonic properties of BLG have not been fully explored experimentally despite broad interests. Here, we report infrared nano-imaging and nano-spectroscopy of surface plasmons (SPs) in BLG. We found that BLG also supported gate-tunable SPs in the mid-infrared range with nevertheless smaller wavelength compared to equally doped single-layer graphene (SLG) and randomly stacked double-layer graphene (DLG). In addition, the coupling between BLG plasmons and SiO2 phonons appeared much weaker compared to SLG plasmons. Further analysis indicated that these observations about SPs in BLG were attributed to interlayer coupling that affects strongly the electronic structure. Our work uncovered all the essential characteristics of BLG plasmons, and suggested the possibility of developing carbon-based plasmonic circuits where SLG, BLG and DLG are all functioning building blocks.

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