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Directed-assembled multi-band moiré plasmonic metasurfaces MARUTHI NAGAVALLI YOGEESH, ZILONG WU, WEI LI, DEJI AKINWANDE , YUEBING ZHENG, Microelectronics Research Center, The University of Texas at Austin — With the large number of component sets and high rotational symmetry, plasmonic metamaterials with moiré patterns can support multiple plasmonic modes for multi-functional applications. Herein, we introduce moiré plasmonic metasurfaces using both gold and graphene, by a recently developed directed-assembled method known as moiré nanosphere lithography (MNSL). The graphene moiré metasurfaces show multiple and tunable resonance modes in the mid-infrared wavelength regime. The number and wavelength of the resonance modes can be tuned by controlling the moiré patterns, which can be easily achieved by changing the relative in-plane rotation angle during MNSL. Furthermore, we have designed a metal-insulator-metal (MIM) patch structure with a thin Au moiré metasurface layer and an optically thick Au layer separated by a dielectric spacer layer. Benefiting from the combination of moiré patterns and field enhancement from the MIM configuration, the moiré metasurface patch exhibits strong broadband absorption in the NIR (˜1.3 μm) and MIR (˜5 μm) range. The dual-band optical responses make moiré metasurface patch a multi-functional platform for surface-enhanced infrared spectroscopy, optical capture and patterning of bacteria, and photothermal denaturation of proteins.

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