Reconfigurable Molecularization of Terahertz Meta-Atoms

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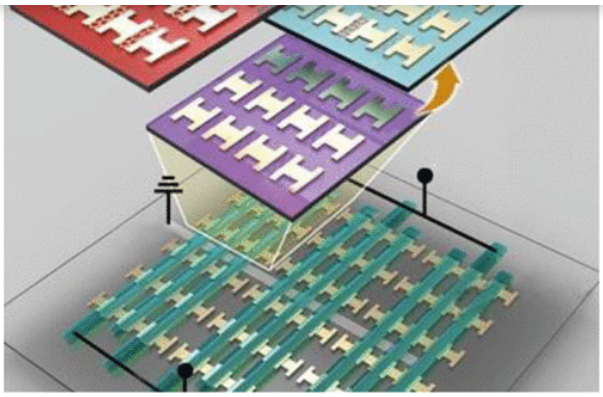
SUBJECTS: Color,

Abstract

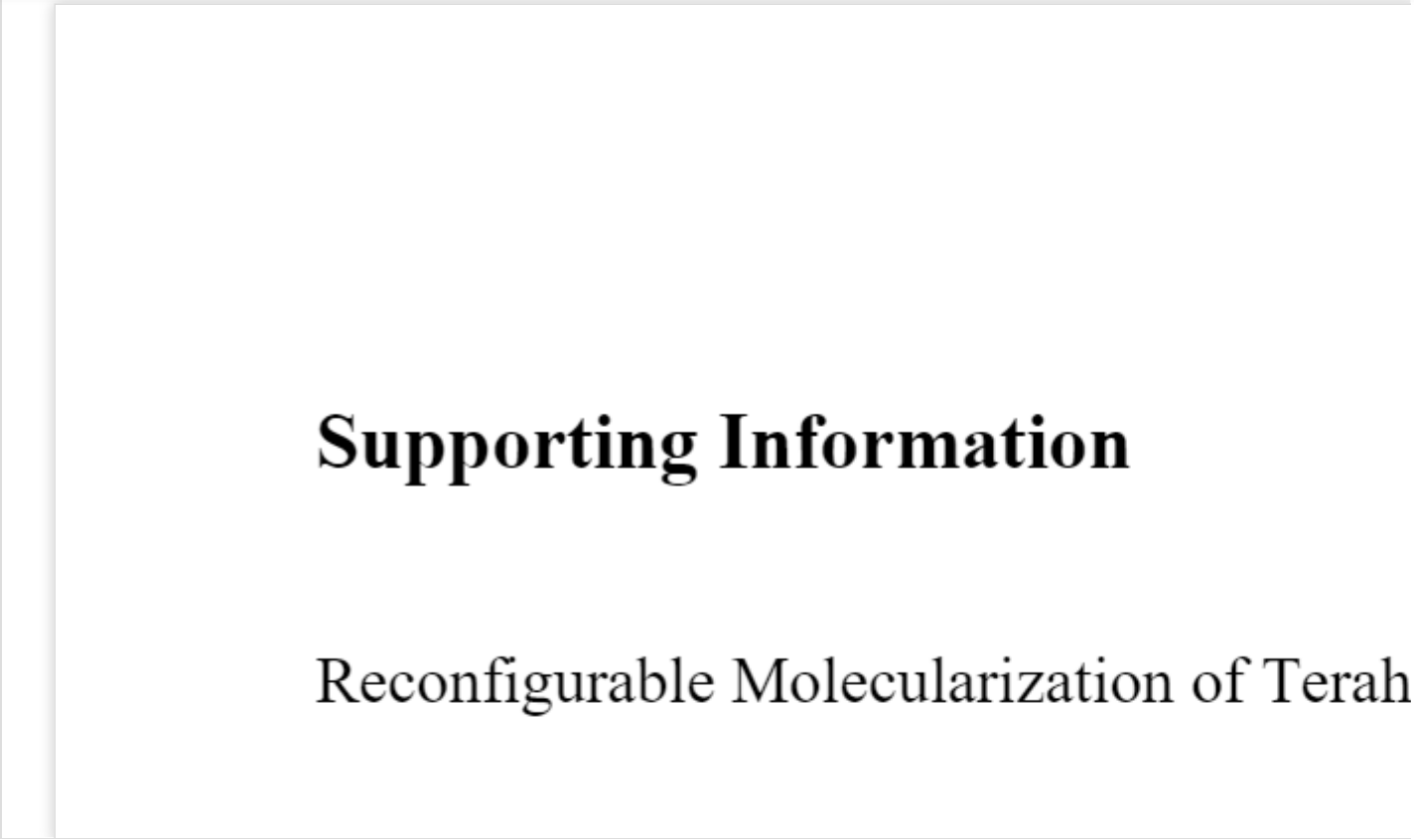


Active terahertz metamaterial devices with controllable resonance properties have been commonly investigated. However, owing to the limited tunability of their frequencies and low-quality factor resonances, these devices are difficult to adopt as single-device filters that can actively adjust diverse spectral information. Moreover, they typically require complex instrumentation for regulating terahertz waves. In this paper, we propose reconfigurable molecularization of terahertz meta-atoms allowing on-demand realization of resonance characteristics in a single active terahertz metasurface. This is achieved by selectively controlling the electrical connections between the meta-atoms using micropatterned ion-gel gating structures. Based on this operation scheme, the resonance characteristics of the terahertz metamaterial can be controlled electrically, and it can serve as a multistate, transmissive metamaterial filter with resonance frequencies tunable from 0.5 to 1.3 THz. In addition, the reconfigurable molecularization of terahertz meta-atoms allows producing a transmissive metamaterial showing controllable transmission resonance to terahertz waves. Exploiting the versatility of an active metasurface, we demonstrate terahertz dichromatic vision distinguishing different saccharides without using spectroscopy systems.

KEYWORDS: molecularization, metamaterial, terahertz, ion-gel, graphene

Supporting Information

The Supporting Information is available free of charge at
https://pubs.acs.org/doi/10.1021/acsphotonics.2c00207



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