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NANOMITE-DECORATED NANOPARTICLES AS SURFACE-ENHANCED SPECTROSCOPY SUBSTRATES

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Surface-enhanced spectroscopy substrates utilize the localized surface plasmon resonance of nanoparticles for optical, photocatalysis, and biological and chemical sensing applications. Plasmonic anisotropic nanoparticles with sharp tips focus the electromagnetic field of the localized surface plasmon resonance into a small volume, thereby producing a local electric field enhancement. Top-down fabrication and bottom-up synthesis of nanoparticles provide different benefits to preparing nanoparticle assemblies used in surface-enhanced spectroscopies. Fabricated nanostructures have very reproducible geometries and defined surface areas. Synthesized nanoparticles can have larger enhancements due to finer control of shape via facet passivation. However, synthetic nanoparticles can aggregate and fall out of solution, making their use somewhat limited. By combining top-down fabrication with bottom-up synthesis, we have fabricated gold nanostructures and added branched clusters using a seeded synthesis. The clusters resemble nanomites covering the underlying plasmonic structure, and the sharp tips provide excellent enhancement of the localized surface plasmon resonance without risk of aggregation. The resulting structures were examined under infrared-microscopy, surfaced-enhanced infrared microscopy, and scanning-electron microscopy, revealing synthesized structures with high levels of branching that yielded high refractive index sensitivity and the potential for increased enhancement in the infrared region.