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Tunable Plasmonic Nanoparticles with Catalytically Active High-Index Facets HAO JING, University of South Carolina, NICOLAS LARGE[1], Northwestern University, QINFENG ZHANG, University of South Carolina, PETER NORDLANDER, Rice University, HUI WANG, University of South Carolina
— Noble metal nanoparticles have been of tremendous interest due to their intriguing size- and shape-dependent plasmonic and catalytic properties. Combining tunable plasmon resonances with superior catalytic activities on the same metallic nanoparticle, however, has long been challenging because nanoplasmonics and nanocatalysis typically require nanoparticles in two drastically different size regimes. Here, we demonstrate that creation of high-index facets on subwavelength metallic nanoparticles provides a unique approach to the integration of desired plasmonic and catalytic properties on the same nanoparticle. Through site-selective surface etching of metallic nanocuboids whose surfaces are dominated by low-index facets, we have controllably fabricated nanorice and nanodumbbell shaped particles, which exhibit drastically enhanced catalytic activities arising from the catalytically active high-index facets abundant on the particle surfaces. The nanorice and nanodumbbell particles also possess appealing tunable plasmonic properties that allow us to gain quantitative insights into nanoparticle-catalyzed reactions with unprecedented sensitivity and detail through time-resolved plasmon-enhanced spectroscopic measurements.

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