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Energy and Spatially Resolved Measurements of Plasmonically Enhanced Photocurrent in a Single Si Nanowire with Au Nanoparticles

JEROME HYUN, LINCOLN LAUHON, Department of Materials Science and Engineering, Northwestern University — Hybrid assemblies of nanowires and metallic particles have attracted great interest because of their potential as light harvesting systems. Optoelectronic measurements of the most basic light absorbing unit in such systems, consisting of a single nanowire and plasmonic particles, would provide further guidance for performance optimization schemes. Here, we present spatially and energy resolved photocurrent measurements across the visible spectrum on a Si nanowire device with Au nanoparticles using a confocal scanning microscope and a tunable wavelength laser source. A 50 nm diameter nanowire was used due to its monotonic optical response in the wavelength range of interest, and 50 nm size Au nanoparticles were selected in order to neglect the effects of Mie scattering. The photocurrent is shown to depend on the azimuthal location of the nanoparticles on the nanowire. Nanoparticles resting on the substrate adjacent to the nanowire can significantly modify the absorption with a strong polarization-dependent plasmonic response while nanoparticles resting directly in the line of sight between the nanowire and light source show minimal contribution to the photocurrent.

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