Plasmonic Photoelectrochemical Cells and Photocatalysts for Solar Fuel Production

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Photoelectrochemical cells and photocatalysts are being explored for production of clean fuels from renewable sources such as water, carbon dioxide and biomass. However, the practical applications of photoelectrochemical cells and photocatalysts are hindered by their low energy conversion efficiency. Herein we show how to utilize surface plasmon resonance to improve the energy conversion efficiency.

Recently we have developed the plasmonic metal-semiconductor core-shell nanoparticles and a plasmonic semiconductor nano-array to extend the light absorption wavelength range and to enhance the solar energy conversion efficiency. In addition, our recent work shows that plasmonic metal-semiconductor heterostructure can increase the light absorption and scattering, which enhances the charge separation in the semiconductor, leading to an increase in the photocurrent in the photoelectrochemical cell. Moreover, our recent studies show that charge separation in the semiconductor can be enhanced via the plasmon-induced resonance energy transfer mechanism from a metal to a semiconductor besides the direct electron transfer process from a metal to semiconductor.