

Nanostructure-based Novel Photovoltaic Devices

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We have focused on two major topics relevant to photovoltaic device physics: (1) light management using surface plasmons and (2) characterization of nanowire-based radial pn junctions aiming at efficient carrier collection. Regarding the first topic, we have investigated the plasmonic effects on optical properties of ZnO/Ag nanograting structures fabricated by nanoimprint lithography. The grating structures exhibited significant enhancement and broad visible-range photoluminescence (PL) spectra. The surface plasmon (SP) dispersion relation well explained the spectral dependence of the PL intensity and the FDTD simulations clearly showed the enhancement of the electric field distribution at the ZnO/Ag interface. For the second topic, we have investigated photoresponse of a radial heterojunction nanowire diode (RND) array consisting of a ZnO(shell)/Si(core) structure. *In both ultraviolet* UV and visible ranges, the photoresponsivity of the RND was larger than that of a planar thin film diode (PD) owing to the efficient carrier collection with improved light absorption. We will introduce some of the recent experimental results and discuss the physical significance.