Tailoring Charge Recombination in Photoelectrodes Using Oxide Nanostructures - DTU Orbit (09/11/2017)

Tailoring Charge Recombination in Photoelectrodes Using Oxide Nanostructures

Optimizing semiconductor devices for solar energy conversion requires an explicit control of the recombination of photogenerated electron−hole pairs. Here we show how the recombination of charge carriers can be controlled in semiconductor thin films by surface patterning with oxide nanodisks. The control mechanism relies on the formation of dipole-like electric fields at the interface that, depending on the field direction, attract or repel minority carriers from underneath the disks. The charge recombination rate can be controlled through the choice of oxide material and the surface coverage of nanodisks. We provide proof-of-principle demonstration of this approach by patterning the surface of Fe_2O_3, one of the most studied semiconductors for light-driven water splitting, with TiO_2 and Cu_2O nanodisks. We expect this method to be generally applicable to a range of semiconductor-based solar energy conversion devices.

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