Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Enhanced optical absorption by nanocavities inside titania WEIQIANG HAN, LIJUN WU, ROBERT KLIE, YIMEI ZHU, Brookhaven National Laboratory — Titania, a wide band gap semiconductor, can generate powerful oxidants and reductants by absorbing photon energies. Titania has been extensively used in photoelectrochemical systems, such as dye-sensitized titania, a wide band gap semiconductor, can generate powerful oxidants and reductants by absorbing photon energies. To improve the photoreactivity of titania, several approaches, including doping and metal loading have been proposed. Nanocavities are isolated entities inside a solid and hence are very different from nanoporous, whose pores (often amorphous and irregular) connect together and open to the surface. Dense polyhedral nanocavities inside single-crystalline anatase titania nanorods were successfully synthesized by simply heating titanate nanorods. The size of the nanocavities is typically about 10 nm. The surfaces of the nanocavity polyhedron are determined to be the crystallographic low-index planes of the titania crystal. We found that these dense nanocavities significantly enhance the optical absorption coefficient of titania in the near-ultraviolet region, thereby providing a new approach to increasing the photoreactivity of the titania nanorods in the applications related to absorbing photons. This work is supported by the U. S. DOE under contract DE-AC02-98CH10886 and Laboratory Directed Research and Development Fund of Brookhaven National Laboratory (to W.H.).

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Date submitted: 05 Dec 2007 Electronic form version 1.4