Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Novel photophysics and tandem device designs for solar hydrogen production JUSTIN JOHNSON, MATT LAW, NATHAN NEALE, ARTHUR FRANK, JOSEF MICHL, ARTHUR NOZIK, National Renewable Energy Lab — Solar hydrogen production by water photolysis could provide a means for generating large quantities of clean, transportable fuel cheaply and efficiently for a wide variety of energy uses. Previous schemes of solar hydrogen production have not resulted in a suitable combination of high efficiency, low cost, and good long-term stability to meet requirements for their practical utilization in large-scale energy production. Revolutionary technologies and application of novel photophysical concepts represent a pathway toward overcoming current barriers and achieving an entirely practical method for producing solar fuels. One such concept is the utilization of tandem device designs, which allow for the incorporation of visible/near-IR absorbing materials into the device, thus increasing solar flux harvesting. Moreover, including molecules capable of charge multiplication (multiple electrons/holes per single photon) holds the prospect for additional gains in solar-to-hydrogen efficiencies. Current progress as well as future challenges for developing such devices will be discussed, including simulations, fundamental spectroscopic experiments, and device design and construction.

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Date submitted: 03 Dec 2006 Electronic form version 1.4