Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Low Intensity UV Treatment of Zinc Oxide Nanocrystal Thin Films[1] GUNNAR NELSON, Creighton University, BEN GREENBERG, ERAY AYDIL, UWE KORTSHAGEN, University of Minnestoa — Thin films composed of ZnO nanocrystals (NC) synthesized using nonthermal plasmas show great potential as inexpensive transparent conductors. A compact film of NCs can be formed rapidly via supersonic impaction of the plasma effluent onto a variety of substrates, and the optical and electronic properties of the film can be tuned by changing NC size. However, electron-trapping hydroxyl (OH) groups terminate the surfaces of the as-deposited NCs, resulting in low electrical conductivities. Previously, this problem was solved by infilling the films' pores with Al2O3 via atomic layer deposition (ALD), but this slow post-deposition process is incompatible with rapid thin film production. To develop an alternative to the ALD treatment, we investigate electron trap removal via UV irradiation. We observe that ZnO NCs exposed to UV light centered at 365 nm under an N2 atmosphere show a decrease in OH vibrational absorption as measured by Fourier Transform Infrared Spectroscopy (FTIR). A localized surface plasmon resonance (LSPR) feature corresponding to a free electron density on the order of 1019 cm-3 emerges in the FTIR spectrum after two seconds of UV exposure. Subsequent air exposure brings back the OH absorption and eliminates the LSPR. We explain the free electron photogeneration in terms of interactions between photogenerated excitons and electrons trapped by OH groups.

[1]Work supported by National Science Foundation through University of Minnesota MRSEC, Award Number DMR-1420013.

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Date submitted: 11 Nov 2016 Electronic form version 1.4