Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Interface Dielectric Function in ZnO/Ag Structures for Applications as Back-Reflectors in Thin Film Solar Cells DEEPAK SAINJU, NIKOLAS PODRAZA, JIAN LI, ROBERT COLLINS, University of Toledo, Ohio, MAARIJ SYED, Rose-Hulman Institute of Technology — Sequential deposition of optically-opaque Ag followed by the transparent conductor ZnO, both by magnetron sputtering on substrates such as stainless steel, is a key process for efficient optical back-reflectors (BRs) of thin film solar cells. The roughness scale investigated in our work is an order of magnitude smaller than that studied previously. We have first analyzed Ag deposition by real time spectroscopic ellipsometry (RTSE) over the energy range from 1.0 eV to 6.5 eV in order to establish the final roughness thickness on the Ag just prior to *in situ* deposition of ZnO. Values from 10 to 50 Å are obtained, for a relatively narrow range of substrate temperature (20-90 $^\circ$ C). We employ the same RTSE probe to analyze the interface and bulk optical properties of ZnO and thus deduce a complete optical model of the BR. Our model for the dielectric function of the interface layer helps explain the losses in the BR structure. It includes contributions from free electrons associated with the Ag component, and bound electrons associated with a metal particle plasmon resonance near 2.7 eV and with interband transitions from Ag and ZnO. The effect of the interface layer on reflectance of BR structures is evaluated.

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Date submitted: 06 Dec 2005 Electronic form version 1.4