

EPFL STI IMT-NE PV-LAB

Seminar

Monday 31th January 2011

MT 2 10.00 - ~11.00

Rue A.-L. Breguet 2, CH-2000 Neuchâtel

Effect of Work-Function Engineering of p^+ /TCO interface on the Performance of a-Si:H Solar Cells

Jeehwan Kim, Ph.D
Research Staff Member
Si Photovoltaics
IBM T.J. Watson Research Center
Yorktown Heights, NY 10598

ABSTRACT

Addition of carbon into p-type “window” layers in amorphous Si solar cells enhances short circuit currents and open circuit voltages by a great deal. However, amorphous Si solar cells with high carbon-doped “window” layers exhibit poor fill factors due to a Schottky barrier-like impedance at the interface between a-SiC:H windows and transparent conducting oxides (TCO), although they show maximized short circuit currents and open circuit voltages. The impedance is caused by an increasing mismatch between the work function of TCO and that of p-type aSiC:H. Applying ultrathin high work-function metals at the interface between the two materials results in an effective lowering of the work function mismatch and a consequent ohmic behavior. If the metal layer is sufficiently thin, it forms nanodots rather than a continuous layer which provides light scattering. Significant efficiency enhancement was demonstrated by using high work-function materials for engineering the work-function at the key interfaces to raise fill factors as well as photocurrents.