Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Absorption enhancement in amorphous silicon thin films via plasmonic resonances in nickel silicide nanoparticles[1] JORDAN HACHTEL, XIAO SHEN, SOKRATES PANTELIDES, Vanderbilt University, RITESH SACHAN, CARLOS GONZALEZ, ONDREJ DYCK, SHAOFANG FU, RAMKI KALNAYARAMAN, PHILLIP RACK, GERD DUSCHER, University of Tennessee at Knoxville — Silicon is a near ideal material for photovoltaics due to its low cost, abundance, and well documented optical properties. The sole detriment of Si in photovoltaics is poor absorption in the infrared. Nanoparticle surface plasmon resonances are predicted to increase absorption by scattering to angles greater than the critical angle for total internal reflection (16° for a Si/air interface), trapping the light in the film. Experiments confirm that nickel silicide nanoparticles embedded in amorphous silicon increases absorption significantly in the infrared. However, it remains to be seen if electron-hole pair generation is increased in the solar cell, or whether the light is absorbed by the nanoparticles themselves. The nature of the absorption is explored by a study of the surface plasmon resonances through electron energy loss spectrometry and scanning transmission electron microscopy experiments, as well as first principles density functional theory calculations. Initial experimental results do not show strong plasmon resonances on the nanoparticle surfaces. Calculations of the optical properties of the nickel silicide particles in amorphous silicon are performed to understand why this resonance is suppressed.

[1]Work supported by NSF EPS 1004083 (TN-SCORE).

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Date submitted: 19 Nov 2012 Electronic form version 1.4