Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Nanowire-based solar cell fabricated by nanosphere lithography
OKI GUNAWAN, SUPRATIK GUHA, IBM T.J. Watson Research Center — Nanowire (NW) structures have been predicted to provide performance enhancement for solar cells due to improved light absorption [1] and (for radial $p-n$ junction geometry) improved carrier collection [2]. We report the development of NW-based solar cells fabricated using nanosphere lithography. This method provides a simple, scalable, low cost and high throughput technique to define large scale NW structures. The fabricated NW solar cells (0.25 μm diameter and 1.3 μm tall) on a p-Si (100) substrate show $\sim$30 % higher short-circuit current and $\sim$4 % higher open circuit voltage compared to the control cells (without any NWs) with baseline efficiency of 6.2 %. The reflectance and quantum efficiency spectra reveal some advantages and shortcomings of the NW-based solar cell. This work marks some progress in the development of a scalable nanowire-based solar cell and highlights some key issues such as conformal-junction formation, surface passivation, and contact formation. [1] L. Hu and G. Chen, Nano Lett. 7, 3249 (2007). [2] B. M. Kayes *et. al.* , J. Appl. Phys. 97, 114302 (2005).

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Date submitted: 02 Dec 2008 Electronic form version 1.4