Abstract Submitted
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15% Power Conversion Efficiency from a Gated Nanotube/Silicon Nanowire Array Solar Cell[1] MAUREEN K. PETTERSON[2], MAXIME G. LEMAITRE, YU SHEN, POOJA WADHWA[3], JIE HOU, SVETLANA V. VASILYEVA, Dept. of Physics, University of Florida, IVAN I. KRAVCHENKO, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, ANDREW G. RINZLER, Dept. of Physics, University of Florida — Despite their enhanced light trapping ability the performance of silicon nanowire array solar cells have, been stagnant with power conversion efficiencies barely breaking 10%. The problem is understood to be the consequence of a high photo-carrier recombination at the large surface area of the Si nanowire sidewalls. Here, by exploiting 1) electronic gating via an ionic liquid electrolyte to induce inversion in the n-type Si nanowires and 2) using a layer of single wall carbon nanotubes engineered to contact each nanowire tip and extract the minority carriers, we demonstrate silicon nanowire array solar cells with power conversion efficiencies of 15%. Our results allow for discrimination between the two principle means of avoiding front surface recombination: surface passivation and the use of local fields. A deleterious electrochemical reaction of the silicon due to the electrolyte gating is shown to be caused by oxygen/water entrained in the ionic liquid electrolyte. While encapsulation can avoid the issue a non-encapsulation based solution is also described.

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