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**Broadband Solar Energy Harvesting in Single Nanowire Resonators** YIMING YANG, XINGYUE PENG, STEVEN HYATT, DONG YU, UC Davis — Sub-wavelength semiconductor nanowires (NWs) can have optical absorption cross sections far beyond their physical sizes at resonance frequencies, offering a powerful method to simultaneously lower the material consumption and enhance photovoltaic performance. The degree of absorption enhancement is expected to substantially increase in materials with high refractive indices, but this has not yet been experimentally demonstrated. Here, we show that the absorption efficiency can be significantly improved in high-index NWs, by a direct observation of 350% external quantum efficiency (EQE) in lead sulfide (PbS) NWs. Broadband absorption enhancement is also realized in tapered NWs, where light of different wavelength is absorbed at segments with different diameters analogous to a tandem solar cell. Our results quantitatively agree with the finite-difference-time-domain (FDTD) simulations. Overall, our single PbS NW Schottky solar cells taking advantage of optical resonance, near bandgap open circuit voltage, and long minority carrier diffusion length exhibit power conversion efficiency comparable to single Si NW coaxial p-n junction cells, while the fabrication complexity is greatly reduced.

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