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Resonant TCO nanostructures for improved light trapping in thin-film photovoltaics ALOK VASUDEV, MARK BRONGERSMA, Stanford University — The desire for widespread photovoltaic (PV) adoption has motivated many recent efforts in advanced photon management in thin-film solar cells. Approaches to enhance PV optical absorption by exploiting surface plasmon resonances in metallic nanostructures, in particular, have been extensively studied. Here we present an alternative means to improve light trapping in thin-film solar cells using resonant transparent conductive oxide (TCO) nanostructures. Dielectric nanowires support leaky mode resonances, which, in poorly absorbing media, can scatter light efficiently. This resonant scattering can enhance optical absorption in a nearby photoabsorber. Using finite difference frequency domain (FDFD) techniques we show that an optimized planar solar cell's performance is improved by patterning the TCO into resonant scatters. Unlike their plasmonic counterparts, these resonators do not suffer large absorption losses, depend strongly on polarization or force a radical change in processing. We will discuss scalability, future improvements and application to a variety of solar cell configurations.

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