

Abstract Submitted
for the NEF13 Meeting of
The American Physical Society

Very high transmittance, back-illuminated, silicon-on-sapphire universal substrate for high energy conversion efficiency photovoltaic device applications ALVIN G. STERN, AG STERN, LLC — There is a growing need for a universal solution that allows the air mass (AM) 1.5 solar irradiance spectrum having a broad wavelength range from the ultraviolet to the midwave infrared between 280-4000 nm, to be transmitted with very high efficiency approaching 100 percent into silicon to support the development of high energy conversion efficiency photovoltaic (PV) devices. Due to the high costs of back-illuminating light detectors, needed for achieving high quantum efficiency in devices, most commercial silicon PV panels are at present front-illuminated and as a result attain module efficiencies of only 15 percent whereas the maximum energy conversion efficiency using silicon single junction PV devices could be as high as 30 percent. We have designed a novel, very high transmittance, back-illuminated silicon-on-sapphire (SOS) substrate that enables 93.7 percent of the full AM 1.5 solar irradiance spectrum to be transmitted into the silicon semiconductor layer to enable PV light detectors that could also include advanced, multijunction, bandgap engineered device architectures, to operate at their maximum theoretical limits of efficiency. Fabrication of the novel substrate presents a unique set of challenges that we are endeavoring to overcome.

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Date submitted: 13 Sep 2013

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