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Theoretical and Practical Limits for Transparent Photovoltaics
RICHARD LUNT, Michigan State University — Transparent photovoltaics (TPVs) offer a new paradigm for solar energy harvesting, integration, and deployment. These devices have recently been shown to be enabled by exploiting the excitonic nature of molecular and organic semiconductors.[1] Here, we present the theoretical and practical efficiency limits of these novel electronic architectures as a function of bandgap, transparency and aesthetic quality for both single and multi-junction cells. For example, power-production from ultraviolet and near-infrared photons alone leads to a theoretical single-junction efficiency of 21% in completely transparent structures, compared to 33% for opaque-junctions. This approach for transparent photovoltaics will be contrasted with other semi-transparent approaches, where TPVs with selective absorption offer the highest possible potential for combined transparency and efficiency. The impact of transparent PVs will be discussed for a range of applications from electronic displays to window integration.

[1]R. R. Lunt, and V. Bulović. Appl. Phys. Lett. 98, 113305, 2011.

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