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Organic Photovoltaic Portfolio

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Improved Organic Photovoltaics Performance

Organic photovoltaic (OPV) efficiency, which is currently at less than 3%, can be greatly improved by the use of tuned resonant cavities in the OPV cell that harness the power of surface plasmon waves generated by incident light and confined between the electrodes. This advance allows lower cost, flexible metals such as silver and aluminum to replace rigid, expensive Indium Tin Oxide (ITO), the current “gold standard” for OPV electrodes. Use of these materials is expected to enable compatibility with reel-to-reel manufacturing, thereby decreasing manufacturing cost and increasing mass-marketability. Additionally, a dilute electron-donor layer has been added to the photovoltaic architecture, providing precise control over exciton diffusion length. This improves the cell’s consistency, reducing operation costs.

Quantum Efficiency Unlocks Possibilities

A charge-graded material heterojunction has been introduced to the OPV layers that reduces the backflow of excited electrons and reduces inefficiencies caused by sudden material change. The graded heterojunction can be manufactured in one pass, greatly simplifying fabrication and has been demonstrated to increase quantum efficiency to 4%. Solar cell efficiency has been one of the OPV industry’s greatest obstacles especially compared to expensive, inflexible silicon-based cells. This advance allows OPV technology to be used for flexible, wearable solar cells for personal electronics. In general, OPVs have a much lower manufacturing cost because they can be printed reel-to-reel onto flat, flexible substrates. Currently eclipsed by rigid, expensive silicon-based solar cells, these improvements in

efficiency allow OPVs to re-enter the picture as standard solar cell architecture. Advances in organic photovoltaic efficiency provide the opportunity to drive the solar cell industry into specific applications in the mainstream energy market. Several University of Minnesota technologies address this huge market opportunity.

BENEFITS AND FEATURES OF ORGANIC PHOTOVOLTAIC PORTFOLIO:

- Plasmonic cavities harness energy in electrodes for higher conversion efficiency.
- Inexpensive aluminum and silver replace rigid, costly ITO electrodes to reduce material expenses and manufacturing costs.
- An electron-donor OPV layer improves reliability by controlling exciton diffusion length.
- Graded heterojunctions facilitate directional charge flow, improving quantum efficiency.

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