Economical, Practical and High-Performance Photovoltaics by Incorporation of Wrinkles and Folds

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Technology description

Optical manipulation of light has become an increasingly popular strategy to enhance light harvesting efficiencies in opto-electronic devices. Despite recent advances in nano-scale patterning techniques that have enabled the creation of discrete metallic building blocks or continuous metallic films having nano-hole arrays, the necessity to precisely engineer and accurately place such objects at pre-specified spacings and at appropriate interfaces over large areas has precluded the practical adoption of this strategy to enhance light harvesting efficiencies in opto-electronic devices.
Researchers at Princeton University have developed novel photonic structures for photovoltaic and other optoelectronic applications. By introducing wrinkles and deep folds ¿ easily accomplished processing methodologies that are low-cost and amendable over large substrate areas ¿ to surfaces onto which polymer photovoltaics are constructed, these devices demonstrate substantial improvements in light harvesting efficiencies, particularly in the near-infrared region where light absorption has otherwise been minimal. This straightforward introduction of surface photonic structures has not only effectively extended the useful range of solar spectrum for photocurrent generation, it has substantially increased the mechanical robustness of devices.

Application area

·Photovoltaic devices
·Other optoelectronic devices

Advantages

40% increase in solar cell efficiency
600% augmentation in the external quantum efficiency for the near-infrared light
200 nm of wavelength extension in the useful range of solar energy conversion
Low cost to manufacture
Straightforward, non-chemical approach

Ease of implementation
Mechanical robustness (enhanced bendability)

Institution

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