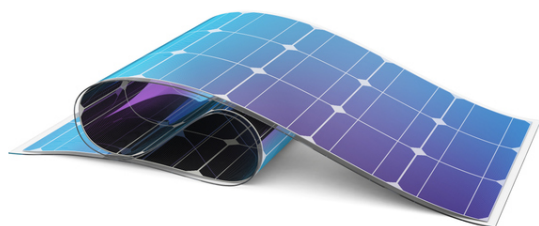




# Roll-To-Roll Process for Polymer Solar Cells

TECHNOLOGY NUMBER: 4581



## Technology ID

4581

## Category

Manufacturing Process  
Engineering & Physical Sciences  
Semiconductor, MEMS, and  
Electronics

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## OVERVIEW

Improved efficiency and scalability of polymer solar cells via innovative processing method

- Optimizes blend morphology, enabling better charge pathways and higher efficiency
- Renewable energy generation, portable electronics, building-integrated photovoltaics

## BACKGROUND

The global energy crisis and environmental pollution problem has driven significant interest in renewable energy sources, with solar power emerging as a prominent solution. Traditional photovoltaic (PV) technologies, while effective, are often expensive and rigid, limiting their deployment. To address these issues, Bulk Heterojunction (BHJ) polymer photovoltaics have been developed for low-cost, flexible, and easy-to-process solar cells. However, existing methods for optimizing blend morphology, such as thermal annealing (TA) and solvent-assisted annealing (SAA), present several drawbacks, including non-uniform vertical phase distribution and long processing times. These limitations hinder the mass production and overall efficiency of polymer solar cells. There is a need for an improved approach to achieve high efficiency and scalability in BHJ polymer photovoltaic cell fabrication.

## INNOVATION

## Learn more



University of Michigan researchers have developed new method, named ESSENCIAL (Evaporation of Solvent through Surface Encapsulation and Induced Alignment), introducing a gas-permeable cover layer that allows solvent evaporation while protecting the surface and inducing shear flow of the blend solution through applied pressure. This method achieves a more uniform and optimized blend morphology with fine nanodomains and high crystallinity, facilitating efficient charge generation and transportation. Unlike traditional TA and SAA methods, ESSENCIAL is compatible with high-speed dynamic processes, enabling scalability and application in roll-to-roll manufacturing. Real-world applications include renewable energy generation, where ESSENCIAL-enhanced polymer solar cells could power portable electronics and integrate into building materials, contributing significantly to the reduction of carbon emissions and promoting sustainable energy solutions.

## **ADDITIONAL INFORMATION**

### REFERENCES:

Park, H. J., Kang, G., Ahn, S. H., & Guo, L. J. (2010). A Facile Route to Polymer Solar Cells with Optimum Morphology Readily Applicable to a Roll-to-Roll Process without Sacrificing High Device Performances. *Advanced Materials*, 22(35), E247-E253.

<https://doi.org/10.1002/adma.201000250>

### INTELLECTUAL PROPERTY:

[US9184400](#) "Methods of making organic photovoltaic cells having improved heterojunction morphology"