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Multi-Tool Roll-to-Roll Manufacturing Line to Produce Multifunctional Polymer Films

A low-cost, environmentally friendly continuous roll-to-roll melt processing platform substantially enhances polymer film properties for applications like flexible electronics and sensors by precisely organizing functional nanoparticles.

There is an increasing need for multifunctional polymer films for a variety of applications including sensors, flexible electronics, displays, separation membranes, fuel cell membranes, and magnetic recording media. Currently, there is no technology that can enhance the wide range of polymer film properties substantially with the directed alignment of function enhancing nanoparticles utilizing external fields in thickness direction. This will help enhance electrical conductivity, thermal conductivity, ionic conductivity, dielectric constant in thickness direction while keeping the concentration of nanoparticle at very low levels. This facilitates retention of polymer flexibility and transparency while enhancing abovementioned properties

Researchers at Purdue University have developed a 45-foot continuous roll-to-roll platform that uses melt processing to organize nanoparticles in polymer films. It can be used on a wide variety of polymer platforms including photocurable monomers, polymer solutions, and polymer melts filled with nanoparticles for the first time. Because of the latter capability to organize nanoparticles in the melt, the process is environmentally friendly. The overall cost of processing is low.

Advantages:

-May be used on a wide variety of polymer platforms

-Processing cost is low

Potential Applications:

-Electrospinning

-Melt casting

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Category
Chemicals & Advanced Materials/Polymer Science & Smart Materials
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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-Electric field alignment

-Magnetic field alignment

-Laser heating

-Directional crystallization

TRL: 3

Intellectual Property:

Provisional-Patent, 2016-10-26, United States | PCT-Patent, 2017-10-26, WO | NATL-Patent, 2019-04-01, United States | DIV-Patent, 2023-08-21, United States | DIV-Patent, 2025-02-11, United States

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