PURDUE INNOVATES | Office of Technology Commercialization

Roll-to-Roll Nanoforming of Metals Using Laser-Induced Superplasticity

A versatile, scalable, and inexpensive manufacturing process uses a conventional CO2 laser to continuously form accurate metallic nanostructures on flexible polymer substrates, enabling increased throughput for applications in electronics, medical devices, and manufacturing.

Large-scale manufacturing of metallic nanostructures is necessary to exploit their potential applications in a variety of fields such as electronics, biosciences, and medical technology. Many nanopatterning processes enable the cost-effective fabrication of metallic nanostructures, but the required post-patterning steps increase the cost, complexity, and processing time, reducing throughput. Additionally, these steps can affect the crystallinity, sharp corners, and homogeneity of the lateral walls of the final nanostructure.

Researchers at Purdue University have developed a manufacturing process that enables the continuous forming of thin metallic layers with nanoscale accuracy on a variety of polymeric substrates using a CO2 laser as the radiation source. CO2 laser engravers are more conventional and cheaper than current systems in use. The process can be performed at ambient conditions, is scalable, inexpensive, and uses easily fabricated nanomolds. Nanopatterned metallic films can be attached to flexible polymeric substrates with sufficient strength for practical applications. Tuning the laser intensity enables the control of the final hardness and aspect ratio of the fabricated nanostructures. This method is versatile, cost-effective, scalable, and ideal for the development of future applications of metallic nanostructures.

Advantages:

- Increased Throughput

- Can be Performed at Ambient Conditions

- Scaleable

Technology ID

2018-MART-68338

Category

Semiconductors/Fabrication & Process Technologies
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

Authors

Debkalpa Goswami
Ramses Martinez

Further information

Parag Vasekar
psvasekar@prf.org

View online

- Inexpensive

- Control of Final Hardness and Aspect Ratio

- Can Attach Films to Flexible Polymeric Substrates

Potential Applications:

- Electronics

- Medical Devices

- Aerospace and Vehicle Manufacturing

- Biosensors

TRL: 2

Intellectual Property:

Provisional-Patent, 2019-03-18, United States | Utility Patent, 2020-03-05, United States | DIV-Patent, 2024-05-03, United States

Keywords: Metallic nanostructures, large-scale manufacturing, nanopatterning processes, thin metallic layers, nanoscale accuracy, polymeric substrates, CO2 laser, laser engravers, nanomolds, flexible polymeric substrates