PURDUE INNOVATES | Office of Technology Commercialization

High-Speed One-Photon 3D Nanolithography by Controlling Polymerization Inhibition

One-photon nanolithography balances initiation/inhibition to deliver fast, low-cost 3D nanostructures at 120 nm resolution.

Researchers at Purdue University have developed a method for high-speed one-photon nanolithography for resin-based additive manufacturing. By balancing polymerization initiation and inhibition, non-linear intensity response can be achieved. This provides fabrication of 3D nanostructures at levels of speed and resolution competitive with two-photon methods at significantly reduced cost compared to market alternatives (Nanoscribe, Carbon3D). This technology has applications in research and manufacturing industries seeking to fabricate nanostructures at higher throughput and reduced cost without sacrificing the quality benefits of less accessible methods.

Advantages:

- Balances initiation and inhibition to achieve nonlinear intensity response

- Requires only one low-cost laser

- High speed and resolution

Applications:

- Nano-3D structure fabrication

- Additive manufacturing

- Photopolymerization

Technology Validation:

This technology has been validated with an experiment varying scanning speed and power and their effect on the linewidth of the resin to demonstrate nonlinearity. Following this, the system was used to fabricate 2D and 3D structures at a minimum resolution of 120 nm, which is

Technology ID

2020-PAN-69081

Category

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

Authors

Bryan Boudouris

Liang Pan

Xianfan Xu

Further information

Parag Vasekar

psvasekar@prf.org

View online

competitive with 2 photon methods.

Related Publications:

Hsu, S., Chi, T., Kim, J., Somers, P., Boudouris, B. W., Xu, X., & Pan, L. (2021). High-Speed One-Photon 3D Nanolithography Using Controlled Initiator Depletion and Inhibitor Transport. In Advanced Optical Materials (Vol. 10, Issue 4, p. 2102262). Wiley. https://doi.org/10.1002/adom.202102262

TRL: 5

Intellectual Property:

Provisional-Gov. Funding, 2022-12-13, United States

Utility-Gov. Funding, 2023-12-13, United States

Keywords: 3D Printing, Additive Manufacturing, Diode-laser, Micro & Nanotechnology, Nanomanufacturing, Nanostructures, Nanotechnology, photon, Photopolymerization