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3D-Printed Carbon Lattice Targets for Inertial Confinement Fusion

Stanford researchers have developed a scalable method for producing precisely engineered 3D-printed lattice structures for inertial confinement fusion targets. Current fusion target materials often use porous foams to hold and distribute fusion fuel. However, these foams can have uneven pore sizes, irregular internal structures, and inconsistent density, which may reduce fuel uniformity and make target performance harder to reproduce.

This Stanford technology replaces unstructured foam materials with digitally designed carbon, ceramic, or lithium-coated carbon lattice structures. The platform uses high-resolution 3D printing followed by heat treatment to create targets with controlled pore size, geometry, and material composition. This added control may enable more uniform fuel loading, more predictable laser compression, and improved reproducibility in fusion experiments.

The researchers have demonstrated carbon and ceramic lattice spheres and hemispheres that match the hollow, porous shape used in many fusion target designs. The technology offers a potential path toward scalable, higher-precision target manufacturing for next-generation fusion energy systems.

Stage of Development
Prototype

Applications

- Inertial confinement fusion targets
- Fusion power generation systems
- High-throughput fusion target manufacturing
- Laser-driven fusion research
- Carbon and ceramic lattices for energy applications

Advantages

- More uniform fusion fuel loading than conventional items
- Improved target consistency and reproducibility
- Tunable material and structural properties
- Compatible with carbon, ceramic, and lithium-coated materials
- Scalable manufacturing using CLIP/iCLIP printing systems

Publications

- Roberts, T. Researchers design 3D-printed materials for clean energy. *Stanford Report* (2026).

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