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A Laser-Based Local Preheating Process to Enhance the as Built Strength Isotropy of the Fused Filament Fabrication (FFF) Part

Fused filament fabrication (FFF) is a 3D printing process that adds material layer-by-layer to form a 3D object. Today, 3D printing can produce a range of objects from simple children's toys to fully-functioning human hearts. However, the products created by FFF still contain a significant amount of error in terms of structural variability during printing. More specifically, the boundaries created from the layer-by-layer printing do not align, causing structural and bond defects (anisotropy) in the finished material. To increase the dependability of products manufactured from 3D printing, scientists are looking to develop improvements to the current FFF process.

Researchers at ASU have developed a technique to increase uniformity and stability in a material printed via FFF. An IR laser beam focuses on a point on the material's surface and deposits filament from the FFF device. The laser locally increases the temperature enough to stimulate diffusion and randomization of particles, producing a less anisotropic material that is structurally stable. The process mainly relies on a laser, so the assembly easily retrofits onto existing 3D printing machines. Overall, this technology increases the reliability of the products manufactured from FFF, paving the way for future innovation and application of 3D-printed materials.

Potential Applications

- Biomimicry
- 3D printing technology
- Semiconductors
- Prototyping
- Automobile manufacturing

Benefits and Advantages

- Effective – the laser locally increases the temperature of the bonding site to produce materials with increased bond strength and structural uniformity
- Retrofittable – users can integrate the method onto existing machines
- Bifunctional – the laser serves as a guide for the printer to deposit material as well as a source of heat to more uniformly bond the material

For more information about the inventor(s) and their research, please see:

Dr. Keng Hsu's directory webpage