Abstract Template

Abstract Title: Ambient Reactive Extrusion Additive Manufacturing

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Abstract (not more than 300 words)

Additive manufacturing (AM) offers many advantages over traditional manufacturing methods, such as rapid customization of objects with complex geometries and reduced mass. However, the industrial practicability of traditional AM methods using thermoplastic extrusion is limited by slow printing speed, anisotropic material strength (tending to be much weaker in the build direction), thermally induced distortions, poor surface finish and the need for an external heat source on the print head. To solve these problems, we have developed an approach that enables additive manufacturing of 3D objects at ambient temperature (i.e. no external heating) at one to two orders of magnitude faster rates using print heads that are 10X lighter in mass than with industrial scale thermoplastic extrusion. In our approach, two co-reactive liquid resins are mixed and extruded through a nozzle to form a cured 3D object layer by layer. This ambient cure eliminates the internal stresses and bulk distortions that typically hamper manufacturing of large thermoplastic parts, and yields inter-layer covalent bonds that significantly improve the strength of parts along the axis of printing. Utilizing chemistries with rapid ambient kinetics enables 3D parts to be constructed at unprecedented speed. This approach also introduces a new level of versatility for modifying the intrinsic material properties as well as the aesthetics (e.g. color) of end-use products. Moreover, fine tuning the rheology, cure rate and deposition speed enables 3D parts to be printed with a smooth surface finish (a feat that cannot be achieved using thermoplastic printing). By taking advantage of covalent bonding between layers, we are able to bond multiple materials within a single, monolithic object (this has not been demonstrated using any other AM methods to date). Finally, whereas thermoplastic systems require complex thermal management strategies as scale increases, our production method is particularly easy to scale.

Keywords—*Ambient*, *Thermoset*, *Extrusion*, *3D printing*

Recent Publication: **Elsevier Publication, 3D Printing via Ambient Reactive Extrusion**

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