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Investigating Interlayer Bonding in 3D Printing Pressure Vessel Applications

Authors : Cam Minh Tri Tien, Richard Fenrich, Tristan Shelley, Nam Mai-Duy, Allan Malano, Xuesen Zeng

Abstract : Since additive manufacturing is a layer-by-layer deposition approach, good bonding quality between adjacent layers is critically important to achieve optimal mechanical performance, including applications in pressure vessels. The need to enhance the strength of printed products, especially in the build direction where layup gaps and voids exist between the printed layers, has garnered significant attention. The proposed research will focus on improving the current Fused Deposition Modelling (FDM) process to produce polymers reinforced with chopped fibers, utilizing a controlled heat zone to enhance the adhesion between printed layers. Energy will be applied to both printed and printing layers to improve the bonding strength between adjacent layers. Through the enhanced FDM process, the mechanical performance of composite parts will experience a substantial improvement, particularly in the build direction, as compared to current FDM methods. A combination of experimental, numerical, and analytical methods will be employed to demonstrate the enhanced performance of heat-controlled 3D printed parts.

Keywords : 3D Printing, pressure vessels, interlayer bonding, controlled heat
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