Observing the Benefits of the Involvement of Pressure in the Annealing of 3D Printed Components for Higher-Strength Applications

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The goal of this study was to determine if the annealing process of 3D printed polymers could be further enhanced with the addition of constant pressure during the procedure. The purpose is to observe if the potential enhancements of pressurized annealing could lead to higher physical strength, setting up the process to be a viable alternative of introducing 3D printed parts to more demanding situations. The two materials tested in this study are polylactic acid and acrylonitrile butadiene styrene, with each material printed using a traditional fused deposition manufacturing printer into different sized test pieces depending on the test used. In order to study the potential benefits of pressurized annealing, three categories of two materials were tested in two standards. The study tests the layer-perpendicular impact resistance using the ISO 180 pendulum impact standard, and flat-wise flexural strength using a modified version of the ISO 178 standard, using a gravitational source of pressure on the piece. In the study, it was observed for impact testing that pressurized annealing at 60 PSI (the maximum allowable out of safety concerns) has little to no benefit over traditional heat annealing. Size alterations of both types of annealed pieces were very close, found to be within 5% of the original control dimensions, with little to no dimensional changes of the 3D printed components. The project is to receive additional testing through isostatic pressure applied on the pieces instead of air pressure to increase the pressure threshold allowable for testing. An electronic version of the ISO 178 testing rig will be used as well for higher consistency and with the addition of tensile testing through ISO 527.

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