Modeling Influences of Printing Defects on Mechanical Properties of Additively Manufactured Silicone Structures

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Key Words: *Direct Ink Write, Foam Replacement Structures, Mechanical Behavior, Defects*

Additively manufactured (AM) silicone lattice structures provide cushioning, mechanical shock mitigation, stress-relief layers, and vibration attenuation capabilities for packaging and transporting high value assets. Compared with conventional manufacturing approaches, AM silicones promise reliability and the potential for rapid design optimization for with in a wide range of applications and under challenging environments. However, AM processes may introduce structural (voids, inaccurate printing, excess material) or material defects (variations in cure) that influence mechanical response and product performance. While surface defects are easily detected, those that are deeply impeded within the layers of a printed structure are difficult to impossible to observe. How sensitive are the mechanical behaviors of AM silicone lattice structures to anticipated manufacturing defects? Here we focus on direct ink write (DIW) AM silicone structures and present the effects of anticipated defects on their quasi-static and dynamic compression behavior as well as on their response to vibration in preloaded states. Sensitivities of these defects and responses to different lattice geometries are presented.

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