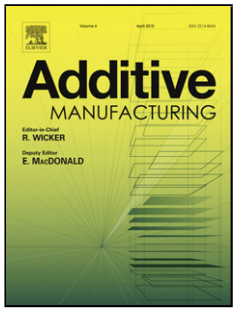

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IMPACT OF EXTENDED SINTERING TIMES ON MECHANICAL PROPERTIES IN PA-12 PARTS PRODUCED BY POWDERBED FUSION PROCESSES

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Abstract

Additive Manufacturing provides many advantages in reduced lead times and increased geometric freedom compared to traditional manufacturing methods, but material properties are often reduced. This paper considers powder bed fusion of polyamide 12 (PA12, Nylon 12) produced by three different processes: laser sintering (LS), multijet fusion (MJF)/high speed sintering (HSS), and large area projection sintering (LAPS). While all utilize similar PA12 materials, they are found to differ significantly in mechanical properties especially in elongation to break. The slower heating methods (MJF/HSS and LAPS) produce large elongation at break with the LAPS process showing 10x elongation and MJF/HSS exhibiting 2.5x the elongation when compared to commercial LS samples. While there are small differences in crystallinity between these samples, the difference may be attributed to changes in the heating and cooling rates of the LAPS samples.

Keywords:

Polyamide 12 (PA 12), Nylon 12, 3D Printing, Additive Manufacturing, Large Area Projection Sintering, Laser Sintering, Semicrystalline, Amorphous

1) Introduction

Additive Manufacturing (AM) refers to processes whereby parts can be formed in three dimensions from CAD files by selectively adding or binding materials without the limitations of tooling or molds necessitated by conventional manufacturing techniques like injection molding (IM) [1-4]. AM parts are formed in three dimensions from the sequential layering of material in two dimensions (XY plane) within the part bed. Laser sintering (LS) is a common AM technology that uses a laser to sinter polymer particles in a powder bed. This laser is scanned at high rates over the powder bed, fusing the material in a point-wise fashion. LS generally