NextManufacturing
Carnegie Mellon University

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12:30 – 1:30 pm

Scott Hall 6142

Characterization of Cell Structures in Additively Manufactured 316L

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Laser powder bed fusion AM of 316L stainless steel typically produces a fine cellular structure underlying the coarser grain structure in the as-built condition. These cellular structures have been associated with the observed enhancements in as-built properties, but their origins and characteristics are not well understood. The cellular features have aspect ratios ranging from equiaxed to very elongated and often exhibit multiple cell orientation domains within a single grain. We have systematically characterized these cellular features to reveal their crystallography, orientation, and shape. In this talk, we will discuss the characteristics of these cellular structures and how they relate to the local crystal growth direction, thermal gradient, and overall build direction.

Parametric Analysis to Quantify Process Input Influence on the Printed Densities of Binder Jetted Alumina Ceramics

Edgar Mendoza Jimenez
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Binder jetting can become a viable method to additively manufacture ceramics. However, the effects of process parameters/inputs on printing outputs (e.g. part density and geometric resolution) have not been investigated and no methodical approach exists for the process development of new materials. In this work, a parametric study explores the influence of seven process inputs on the relative densities of as-printed (green) alumina (Al_2O_3) parts. Sensitivity analyses compare the influence of each input on green densities. Multivariable linear and Gaussian process regressions provide models for predicting green densities as a function of binder jetting process inputs. Results from this study indicate that the green densities of alumina builds can be increased by decreasing the recoat speed and increasing the oscillator speed. The Gaussian process regression model further suggests that the green densities have nonlinear dependence on the rest of the process parameters. The models produced can assist operators in selecting process inputs that will result in a desired green density, allowing for the control of porosity in printed parts with a high degree of accuracy. The methodology reported in this study can be leveraged for other powder systems and machines to predict and control the porosity of binder jetted parts for applications such as filters, bearings, electronics, and medical implants.