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Feature Extraction and Porosity Assessment on Thick Stainless Steel 316 Samples with Embedded Slots

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Abstract

X-Ray Computed Tomography (XCT) is a common technique for evaluating Additively Manufactured (AM) components. The present work uses XCT to measure an array of stainless steel 316 uniaxial tensile specimens with embedded slots throughout the grip length. The samples are scanned simultaneously, stacked front to back with uniform spacing, in a 450 kV cabinet system. The data is reconstructed and evaluated in Volume Graphics VGStudioMAX™ 3.3. Enhanced segmentation methods are used to extract the gage region of each component beyond the influence of noise. Within each gage region the measurement of geometric features and the assessment of porosity is performed. The lower internal signal-to-noise ratio and presence of common artifacts in thick components elicits greater uncertainty in their porosity assessment. Comparisons are drawn between porosity analyses using one of the industry standard solutions. Porosity distribution around the top and bottom, relative to the build direction, of each slot was found to be greater than that of the bulk of the material. Angular deviation and flatness of the gage and slot surfaces are reported. The limitations of XCT in relation to reliable feature extraction, signal-to-noise ratio, part thickness, and ideal voxel size are discussed. Finally, the implications of these results are summarized and recommendations about the information that needs to be given to designers and producers of AM components are made.

Keywords: computed tomography, additive manufacturing, surface determination, porosity analysis.

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