Acoustic Signatures and Machine Learning in Additive Manufacturing

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Abstract:

This presentation will demonstrate how acoustic signatures of Laser Powder Bed Fusion (LPBF) additively manufactured CoCrFeMnNi High Entropy Alloy (HEA) can be used to predict microstructural and material properties of a final part. Additive manufacturing presents a unique challenge to certain nuclear safeguards, and it is of interest to understand the signatures that can identify when and how a part is created. Using high throughput experiments, a processing region was identified for CoCrFeMnNi HEA wherein all processing conditions produced high density high hardness samples. All samples in this region were nominally defect free but microstructural signatures and tensile properties had noticeable variations across the processing region. The acoustic signature of each processing condition was recorded in the 2-16 kHz range using commercial off the shelf equipment. These acoustic signatures were then used to train a Random Forest machine learning algorithm to identify material microstructural signatures of the final parts. The results of these experiment and how this process can be incorporated into future high throughput experiments will be presented.