SIMULTANEOUS TEXTURE AND STRAIN ANALYSIS OF ADDITIVE MANUFACTURED PARTS VIA TILT-A-WHIRL SOFTWARE

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Additive Manufacturing (AM) is a term used to describe the process by which parts are built-up layer-by-layer (e.g. during the 3D printing process) and this new processing technique is of significant interest to government and industry alike for the generation of rapid prototypes and complex shaped items. 3D printing of metal parts can often result in the formation of residual stresses, especially near sharp edges of the printed part. Some aluminum prototype parts created for Sandia's AM programs have demonstrated the presence of residual strains; there is a need to detect and quantify strains in these pieces. Therefore, we have developed a protocol to characterize the presence of residual strain within the Al parts. This protocol is an extension of our recently developed Matlab-based texture analysis software package termed "TILT-A-WHIRL" [see Rodriguez, *et al.* (**2013**) *Powder Diffraction*, **28**, pp. 81-89]. We have extended our analyses of these datasets to include macrostrain analysis via the $\sin^2(\psi)$ technique. We present macrostrain results and the simultaneous texture analysis of Al parts both near and away from high-strain locations. In addition, we shall present results of the same part after an annealing step employed to reduce residual strain in the sample.

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