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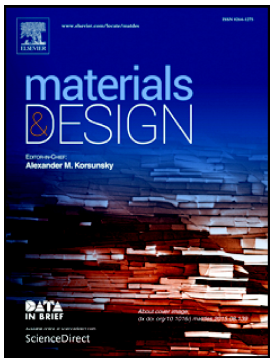

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Residual Stress and Texture Control in Ti-6Al-4V Wire + Arc Additively Manufactured Intersections by Stress Relief and Rolling

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Keywords: Wire + Arc Additive Manufacturing; Intersections; Rolling; Stress Relieving; Ti-6Al-4V; Microstructure

Abstract. Additively manufactured intersections have the theoretical risk to contain hydrostatic tensile residual stresses, which cannot be stress relieved. The stresses in Ti-6Al-4V Wire + Arc Additively Manufactured (WAAM) intersections are lower compared to single pass walls and stresses in continuous walls are larger compared to discontinuous wall with otherwise identical geometry. Thermal stress relief was found to virtually eliminate them.

Inter-pass rolling can yield the desired grain refinement, without having any noteworthy influence on the development of residual stresses. The strain measurement itself by neutron diffraction is facilitated by the refined microstructure, because the textured microstructure produces anisotropic peak intensity, not allowing Pawley refinement. The {1011} and {1013} hcp planes are the only ones that diffract consistently in three orthogonal directions.