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# Enhancing Mechanical Properties through Graded Materials in Multi-Layer Friction Surfacing of Aluminum Alloys

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## Abstract

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Multi-Layer Friction Surfacing (MLFS) has emerged as a promising additive manufacturing technology due to its ability to minimize energy consumption, reduce material waste, and enhance material properties. The mechanical properties of MLFS components can be further improved by incorporating material grading. Graded materials are characterized by a gradual variation in composition and structure, enable tailoring of local material properties. Applying graded microstructures through MLFS enhances the mechanical performance of 7075 aluminum alloys. A significant grading in grain size can be achieved by adjusting deposition parameters between layers and also subsequent post annealing treatment. This work addresses the effect this grading has on fatigue crack propagation favoring crack deviation due to the multi-layer grading.

**Keywords:** Multi-layer friction surfacing, Graded materials, Microstructure, Mechanical properties, Fatigue crack propagation

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