Direct Laser Deposition of Fe-Cr, Fe-Ni and Fe-Ni-Cr Alloys as a Pathway to Additive Manufacturing of High-Entropy Alloys

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ABSTRACT
High-entropy alloys are a novel class of alloys with promising properties for a number of applications. Some of those applications, especially nuclear energy, will require additive manufacturing of these alloys. The high degree of complexity of high-entropy alloys requires elemental powders deposited by powder-fed processes such as direct laser deposition (DLD), but such processes have been known for compositional variation. To study this, binary and ternary alloys of Fe-50%(Ni, Cr), Fe30%(Ni, Cr), and Fe-Ni33%-Cr33% were fabricated via DLD and characterized with scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and electron backscatter diffraction (EBSD). Initial results show large compositional variation from the intended compositions, most of which can be accounted for by differences in particle size, indicating this variable must be carefully controlled in future experiments.