Advanced Additive Manufacturing: Development of a Multiple-Material Selective Laser Melting Machine

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Abstract:

This poster outlines the developmental process and subsystems details for a novel, Multiple-Material Selective Laser Melting (MMSLM) machine. Selective laser melting (SLM), a subset of powder bed fusion (PBF), a laser-based powder sintering based process in the field of Additive Manufacturing (AM). Rather than fusing polymer particulates, however, SLM melts and fuses fine metal powders. MMSLM is an advanced manufacturing technique that enables SLM of multiple materials, allowing for the creation of fully dense metal parts comprising two distinct components. The rapidly expanding field of Multiple-Material Additive Manufacturing (MMAM) is continuously evolving to meet the growing demand for fabricating parts composed of diverse materials.

The novel aspect of the presented MMSLM machine is that it aspires to be the first selective powder deposition method in AM capable of producing fully dense, metal, multiple-material parts. While various research efforts have addressed the MMAM challenge within PBF, these machines differ in their approaches, utilizing rotating powder rollers, drums, selective vacuuming, among other techniques. In contrast, the presented machine will employ multiple nozzles to selectively deposit powder onto the build plate, followed by smoothing with a leveling blade. The design of these nozzles is a focal point for future work in this project, where our group aims to innovate the nozzle for the capability to produce functionally graded materials (FGM)—a significant breakthrough in the realm of MMAM.