Fused Filament Fabrication on the Moon

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Abstract

Additive manufacturing (AM) techniques possess the capabilities to rapidly produce complex and customised parts, typically in low-volume and with reduced material us- age and preparation tools . These attributes magnify their indispensability when the availability of materials and equipment is limited. It can be such a case for off-Earth manufacturing, e.g. in manned lunar explorations. This article presents a preliminary discussion on the possibility of performing fused filament fabrication (FFF) on the Moon from the perspective of heat transfer in printed parts. It makes use of experimen- tal data and simulations to quantify the significance of each heat transfer mechanism taking place during printing. The quantification then enables us to investigate how the lunar environment affects the cooling in the printed parts. Finally, FFF on the Moon is predicted to be feasible. Yet, apparent differences in the process window and types of applications are pointed out as compared with the counterpart printing activities on the Earth.

The full paper may be found in a special issue of the TMS publication *JOM*, March 2022.