3D printing with extraterrestrial materials

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INTRODUCTION

Additive manufacturing and its related powder bed fusion process category, consists of a group of key enabling technologies that allow the fabrication of various structures, directly from computer aided design data by selectively fusing parts of a powder bed, using a thermal source (laser, electron beam etc.) on a successive layer-by-layer manner allowing the fabrication of both intrinsic and complex structures for various applications and in critical environments such as aerospace and astronautics.

PROJECT SCOPE

The prospect of this research approach is to propose and discuss the application of in-space additive manufacturing/3d printing for onsite fabrication of structures [1] and parts [2], using the already available natural resources on site as feedstock. The realisation of such a challenging manufacturing approach in a highly demanding off-world environment, could pose as a key to achieve a sustainable presence in space by providing the ability to build assets and tools needed for long duration/distance missions in deep space.

METHODOLOGY

This study was carried out by using a range of simulants of terrestrial origin, mimicking the bulk chemistry, mineralogy and mechanical properties of those respective materials found extra terram. The candidate materials were processed with commercially available additive manufacturing equipment. An investigation towards material characterisation for powder bed fusion and the results after processing, was conducted via elemental analysis [3], spectrometry [4], optical and scanning electron microscopy [5] and also thermal analyses [6].