An Analysis of Different Finishing Techniques For Surface Roughness Improvement of AM components

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ABSTRACT

The surface roughness of metal components is a deciding factor in whether a component can consistently meet designed geometries and tolerances. In addition, it impacts a wide range of properties such as wear resistance, fatigue life, and plating adhesion. This paper presents an evaluation of different finishing techniques for improving the surface roughness characteristics of metal components produced by Intelligent Layering. Intelligent Layering is a novel binder-assisted, sintering-based technology best defined as a process with additive and subtractive elements. The process is suitable for high-volume metal production. Test samples were printed, sintered, and then split to be processed using different mechanical finishing methods. The change in the surface roughness after each finishing process was quantified and compared.

INTRODUCTION

Additive manufacturing (AM) is a process of using 3D data to fabricate a modeled object by joining materials together, typically layer-by-layer[1]. Through this manufacturing method, parts can be made near-net-shape, or in some cases built as a finished product, with a quick turnaround time. Metal AM processes excel in producing complex shapes or internal features that would typically be constrained by toolpath in purely subtractive manufacturing[2,3]. Metal AM technologies have found their niche in producing low-to-medium volume parts that require low lead times or even potentially customizable products that may not be feasible with metal injection molding (MIM), because of tooling costs[3]. For AM to bridge the gap into higher volume parts and more widespread use, the properties of the parts must be at parity with those parts made in more traditional manufacturing.

One of the common disadvantages of most metal AM processes is that these processes tend to create parts with a higher surface roughness when compared to parts made in traditional manufacturing methods[3]. Surface roughness can be defined as the deviation from the theoretical surface plane of the part.