An Aluminum Powder Feedstock Designed for High-Throughput Additive Manufacturing Processes

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ABSTRACT

As metal powder bed fusion moves to scale and challenge traditional manufacturing processes, it imposes new requirements on the metal powder feedstock. This paper presents a comprehensive characterization of a new, novel aluminum alloy feedstock that is designed for the next generation of high throughput laser powder bed fusion machines. We discuss how powder characteristics such as specific surface area, sphericity, and surface condition impact key powder behaviours such as flowability, packing density, and moisture sorption—and how those behaviours influence the stable processing window. Density results and mechanical data are presented.

1. INTRODUCTION

Additive manufacturing (AM) comprises a series of layer-wise manufacturing processes that have received considerable attention in the last decade due to advantages over subtractive and formative manufacturing methods. AM allows the fabrication of functionally and geometrically complex components, minimizes waste generation, and permits the fabrication of parts on demand [1–3]. Such flexibility improves product development and facilitates the enhancement of operational readiness while reducing energy consumption and warehouse costs by buying just-in-time rather than just-in-case [4].

Laser powder bed fusion (LPBF) is one of the most studied metal additive manufacturing processes, using one or more lasers to melt powder materials layer upon layer to produce parts from 3D designs [5]. As LPBF moves towards industrialization, factors such as powder handling and storage, machine uptime, and aspects relevant to ensuring productivity and safety are gaining importance in high-throughput manufacturing environments. LPBF machines designed for use in high-throughput manufacturing operations, are currently available from equipment manufacturers, including machines with multiple high-power lasers and innovations in the core process technology and powder/part handling systems [6]. It has