THE IMPORTANCE OF POWDERS FOR THE DEVELOPMENT OF ADDITIVE MANUFACTURING

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Abstract. The importance of powders for the development of additive manufacturing Powders are one of the inseparable materials for additive manufacturing. Polymer, metal or ceramics, these have many advantages and make the good days of these technologies. A brief overview with A3DM Magazine The importance of powders for the development of additive manufacturing Powders are one of the inseparable materials for additive manufacturing. Polymer, metal or ceramics, these have many advantages and make the good days of these technologies.

Keywords: A3DM, importance of powders, china, powder, ceramic powders

Introduction. The additive manufacturing sector has enjoyed three booming decades with annual growth of nearly 30%, according to figures from the Wohlers 2020 report. The year 2019 saw annual growth of 21.2% with total revenue of $11.8 billion, a slowdown compared to the previous year, and growth of 33.5% for revenue of $9.79 billion. These figures include sales of additive manufacturing systems, materials and aftermarket products such as software and lasers. They also include services: part production, maintenance contracts, training, communication and research and consulting[1]. Internationally, the main players in the global 3D printing materials market are the American companies 3D Systems Corporation and Stratasys, the Belgian company Materialise NV, the French companies Arkema SA and Armor, but also Evonik Industries AG (Germany), General Electric (United States), ExOne Company (United States), Hoganas AB (Sweden) and Royal DSM NV (Netherlands). The North American and European markets for additive manufacturing materials are doing well. As is the Asia-Pacific region, where many strategies and policies are being pursued by the governments of several countries in the region to create a sustainable additive manufacturing ecosystem. China is one of the main investors in promising additive manufacturing companies. The Chinese government strongly supports the development and standardization of Chinese industry through its “Made in China 2025” strategic action plan[2]. Additive manufacturing based on metal powders works by laser or electron beam fusion. Understanding the properties of powders is essential for the use of these technologies, to reliably produce quality, certified and repeatable parts. As a result, many studies have been conducted on the characteristics of the powder on the properties of the part: by scanning electron microscopy (SEM), by laser light diffraction, by X-ray photoelectron spectroscopy (XPS), but also by differential thermal analysis (DTA). The use of these powder characterization methods makes it possible to study the size and morphology of the particles, the chemical composition and the microstructure of the powder[3]. It offers an in-depth evaluation and optimization of the properties of the metal powder used in additive manufacturing. It is important that the following three main areas are studied: particle morphology, chemistry and microstructure. In powder bed fusion (PBF) processes, research mainly focuses on the morphological characterization of powders and their effect on part properties. The techniques that are typically used to perform this include microscopy and laser diffraction but also, sometimes, sieve analysis. Microscopy allows to characterize not only the particle size and particle size distribution by micrographs, but also the shape and surface roughness. This tool is extremely versatile and attractive in powder-based manufacturing[4]. However, optimizing powder properties poses a serious challenge to researchers. This complication arises not only from the dependence of powder behavior on both the bulk solid properties and their interaction with the additive manufacturing system, but also from the underlying physics of particle-to-particle consolidation. The impact of particle size, shape and surface roughness in powder bed fusion processes has been observed in several studies, concluding that the morphological properties of the powder influence its density after deposition on the manufacturing platform, the sintering kinetics between particles and the surface, the roughness and density of the manufactured parts[5]. Thus, it is essential that the powder properties are studied and controlled to ensure the reliability and repeatability of the components that are produced.

Conclusion

Ceramic Powders Ceramic materials have high-performance properties. They have grown significantly in recent years. However, until the introduction of artisanal manufacturing processes, companies struggled to meet the demand due to the challenges of manufacturing high-performance ceramic (HPC) materials with complex geometries and customized designs. The specific properties of HPC materials include high flexural and tensile strength, high thermodynamic stability (or heat resistance), corrosion, abrasion, and oxidation. They are also extremely lightweight and have high energy conversion capabilities. Special HPC powder materials for additive manufacturing processes have been introduced and are currently being investigated to overcome the limitations and increase flexibility for various applications. They are generally classified into oxides, carbides and nitrides

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