METAL POWDER ATOMIZATION BY ARC-SPRAY PROCESS

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ABSTRACT

With the strong expansion of metal powder related applications and more specifically additive manufacturing, powder suppliers are facing a worldwide growing demand for feedstock, complying with very stringent technical specifications. According to market surveys, total production capacity of gas atomized powders (all applications included) is expected to reach roughly 200 kilotons per year by 2027. From a metal powder producer perspective, developing alternative technologies make it possible to enlarge market opportunities while offering complementary solutions for customers. A literature review of arc-spray suggests good abilities to convert molten metal into powder. As a result, specific developments have been carried out at Air Liquide R&D on an alternative gas atomized powder manufacturing process.

This work presents results obtained with an arc-spray atomizer for titanium alloy (Ti6Al4V) powder production with a specific focus on additive manufacturing applications. In this study, an arc-spray atomizer has been developed to demonstrate the relevance to use this technology as an agile and easy way to produce metal powders for various applications, including additive manufacturing. A proper setting of the electrical parameters and atomisation pressure has been achieved with good productivity, yields, and powder quality. In addition, this technology requires limited floor space with a quite simple design and low electrical consumptions compared to conventional gas atomization technologies.

INTRODUCTION

The powder metallurgy (PM) industry has shown an impressive growth since the past decade, increasing pressure on the supply chain. Despite the fact that the overwhelming majority of powder volumes are produced by water atomization (WA), gas atomization (GA) is becoming year after year, increasingly present in the industry landscape as growing markets are requiring pure, spherical, and defect-free powders. All those processes are, for the most part and in many aspects, energy intensive, and regarding GA, inherently linked to gas use. Argon (Ar), Nitrogen (N_2), Helium (He), and their associated mixtures, are the most represented [1][2]. Recent feedback from powder manufacturers and end-users have highlighted a true willingness from the markets to not only increase atomization plants capacities but also explore alternative processes in order to increase flexibility, application-related efficiency, and above all reduce the carbon footprint [3].

During the 20th century, following the first appearance of GA processes such as Free-Fall Gas Atomization (FFGA) or Closed-Coupled Gas Atomization (CCGA) back in the 40's, powder-related applications have pushed the development of atomization processes. Users of high purity spherical powders now have several options depending on the targeted application and the intended material. Vacuum Inert Gas Atomization (VIGA), Electrode Induction Gas Atomization (EIGA), and Plasma Atomization (PA) represent most of the processes used for metal powder production [1][4].