

Benefits of In-Situ Monitoring in Metal Additive Manufacturing

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ABSTRACT

Metal Additive Manufacturing processes such as Directed Energy Deposition (DED) can produce complex geometries with incredible benefits for applications, but there are challenges between concept design and producing a part. In order to create quality, repeatable parts, in-process monitoring can be utilized to both collect data and control the build process. The data collected can help determine the point of failure initiation, and with implemented control in place, self-correction is possible during the build process. With Directed Energy Deposition, also referred to as Laser Metal Deposition (LMD), various monitoring and control modes are available to reduce parameter development times, improve build quality, and limit operator input during a build. Among these control modes are melt pool size and temperature, powder flow, laser power, and geometric monitoring and control. These control modes not only significantly reduce the process parameter development cycle, but also result in a higher quality build to include density and material properties.

INTRODUCTION

As metal additive manufacturing adoption continues to expand from prototyping and demonstrator components to production components, quality parts and part-to-part replication become necessity. With the aerospace sector being one of the most predominant users of producing components with additive manufacturing and the need to scale to very large parts that are often several feet or more in size, technologies that can offer higher deposition rates are required. Directed Energy Deposition (DED), also referred to as laser metal deposition (LMD), offers deposition rates and scalability required but lacks the analytics, data and installation base as the powder bed systems provide. In order to provide insight into quality of the build during processing, in-process monitoring can be utilized throughout the build.