

The Critical Role of Industrial Gases Throughout the AM Value Chain

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Abstract

As metal additive manufacturing (AM) scales from prototyping to serial production, the process atmosphere is emerging as a practical lever for quality, throughput, safety, and sustainability, well beyond its traditional role as a passive inert function. This presentation introduces Linde's end-to-end view of gases across the AM value chain, from powder atomization and logistics to sieving, storage, printing, and post-processing and shows how atmosphere engineering can measurably de-risk and accelerate industrialization. We first map where gas choices and controls matter: high-purity argon or nitrogen in atomization for sphericity and flowability; inert, dry environments during sieving, storage, and powder handling to preserve powder integrity; and tailored process gases in LPBF to stabilize melt-pool dynamics, manage spatter and fume transport, protect optics, and mitigate reactivity in alloys such as Ti-6Al-4V and Al-based systems.

Using EOS M290 case studies, we demonstrate how tight oxygen control with ADDvance™ O₂ precision (down to ~100 ppm during builds) and the use of helium-argon mixtures reduce spatter emission, lower porosity, and enable faster scan strategies, achieving higher scanning speed while maintaining target density in Ti-6Al-4V lattice builds. We discuss the physical mechanisms (reduced plume shielding, faster vapor-jet dynamics) and the implications for productivity and part quality.

Keywords

Laser Powder Bed Fusion; process gas; helium–argon mixtures; oxygen control; ADDvance™ O₂ precision; powder handling; safety; HIP; productivity; porosity; spatter mitigation.