Additive Manufacturing
AM Technology – What's new?

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Role of Linde within Additive Manufacturing community

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- Additive Manufacturing (AM) is most established within medical, dental and aerospace segments

- Opportunities for industrial AM applications are vast, and will become established but currently early in the development life-cycle

- Active engagement from all stakeholders within the AM ecosystem is required to fully realize AM market potential

- Industrial gases (Ar, N_2, He, CO_2, C_xH_y) play an integral role in the AM manufacturing process

- Linde is leading the development of AM gas applications, improving the quality of components and improving the productivity of our customers

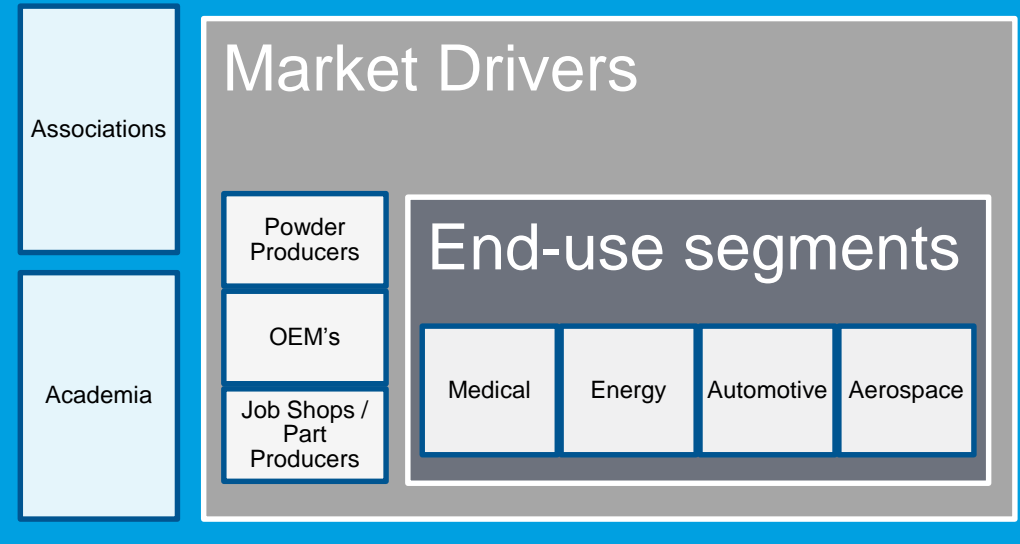| Powder production	L-PBF / EBM	Heat treatment
Powder handling	WAAM	Hot Isostatic Pressing

Ar

N_2

He

CO_2

C_xH_y

Linde Vision

Linde to become a leading, integrated and recognised member of the AM value chain, developing industry-wide standardised industrial gas solutions.

Linde world: our customers, our partners

Market Influencers – Industry Network

Associations	Market Drivers
	Powder Producers
	OEM's
Academia	Job Shops / Part Producers

Market Drivers

End-use segments

Medical	Energy	Automotive	Aerospace

Linde's support to this ecosystem

- Improving productivity
- Increasing reproducibility
- Research limits of the technology
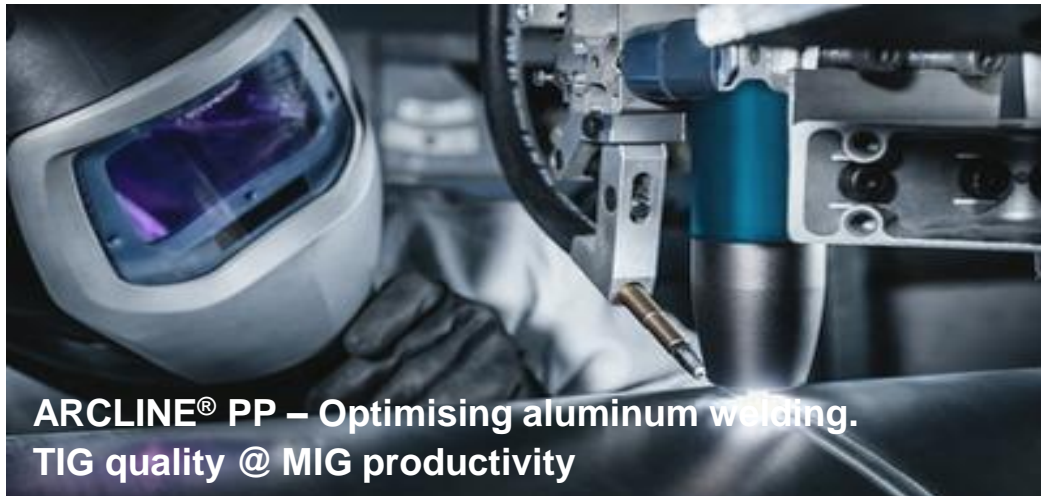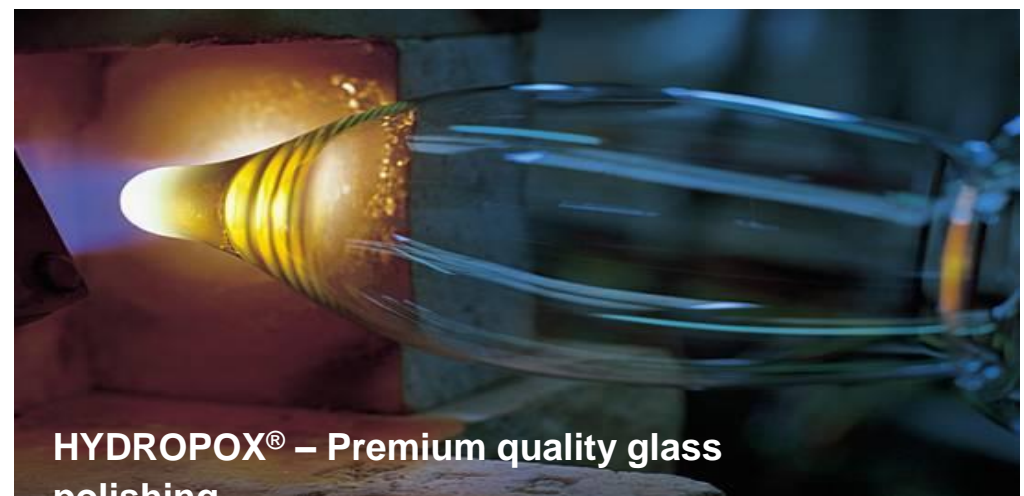- Support automatization and digitalization of AM

SOLVOX® – Fish Farming. Provide optimal living environment for growth of fish reducing

Food Freezing. Naturally extends shelf-life without preservative chemicals such as salts
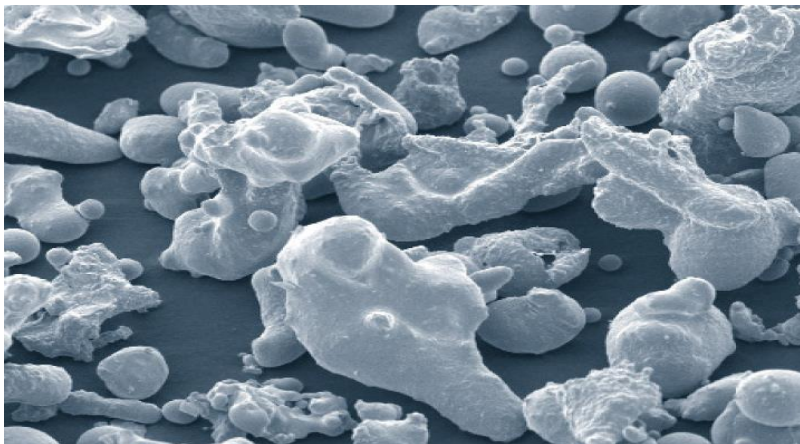

ARCLINE® PP – Optimising aluminum welding. TIG quality @ MIG productivity

HYDROPOX® – Premium quality glass polishing

Influence of gas on powder, WAAM parts and L-PBF parts

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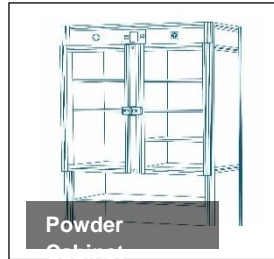**Gases play a role during the production, storage and handling of AM powders**

Example of WAAM part with Varigon S (top) and Argon only (bottom)

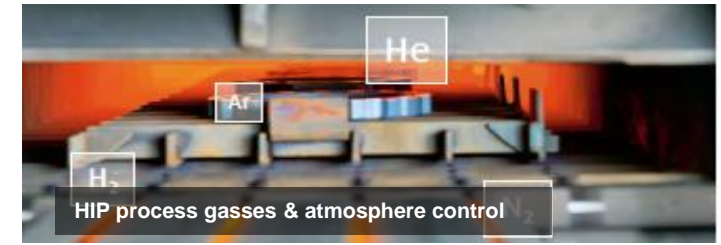**Example of L-PBF porosity with uncontrolled O2 level (bottom) and**

R&D Roadmap
What do we offer today, what is expected tomorrow?

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Powder Production & Handling

Powder process gases

Gas Recycling

Powder Cabinet

High Pressure Gas Supply

Additive Manufacturing

Laser based process gases

Tailored on-site mixes

ADDVANCE® O₂ precision

Active Cooling, WAAM

Oxygen monitoring, safe environment

Post Treatment Processes

HIP process gasses & atmosphere control

CRYOCLEAN® AM

Gas Management

Integration of design know-how across the value chain, focusing on reproducibility & productivity

Thank you.

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