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Numerical Simulation and Image Analysis of a Molten Metal Atomization Focused on the Additive Manufacturing Route

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Research

Aim

- Enhance powder yield from close-coupled assisted gas atomization for additive manufacturing

Objectives

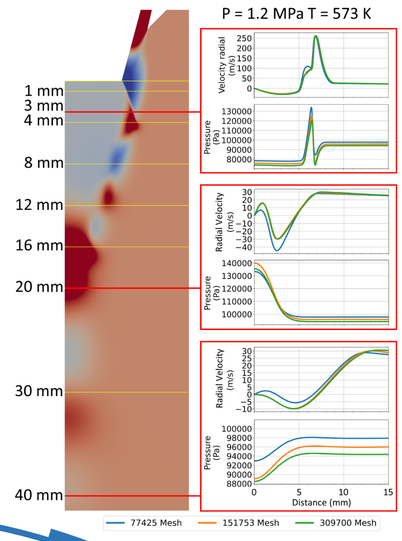
- Understand the effect of atomization gas pressure and temperature during the atomization

Methodology

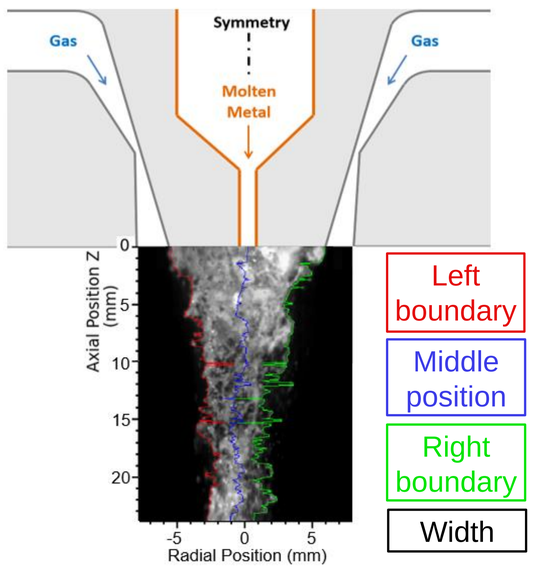
- Extract information from primary breakup region based on high-speed imaging
- Simulate the gas behavior during the atomization process, for the different process conditions

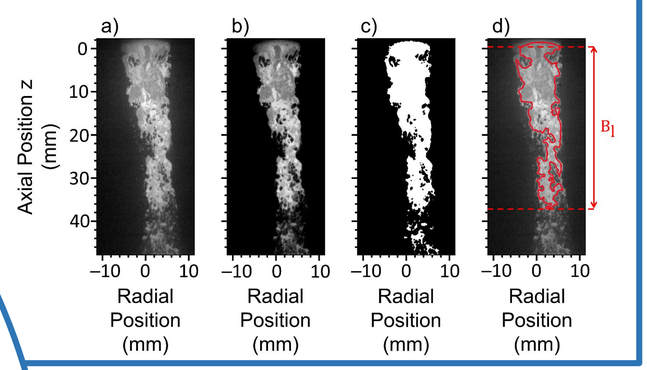
Methodology

Numerical Simulation



High-speed Imaging

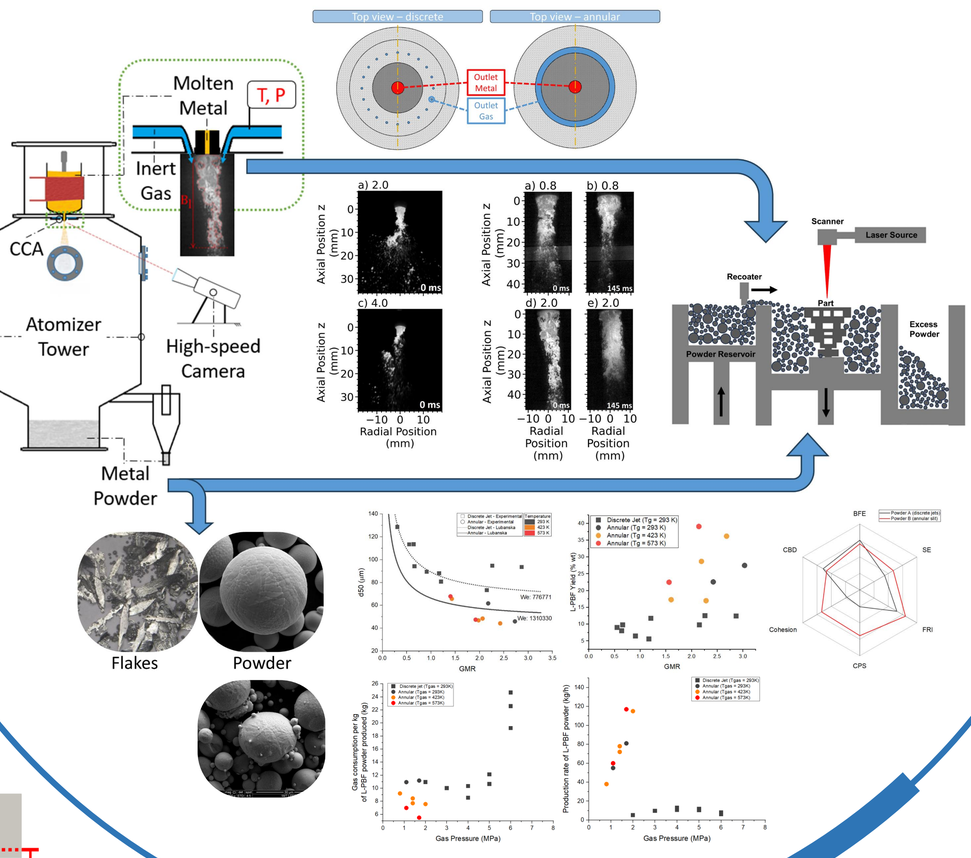




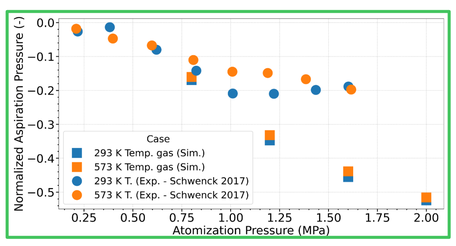
Conclusions

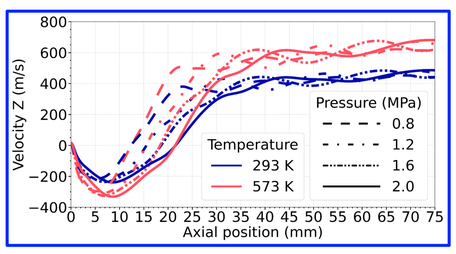
- ↑ Liquid decentralization → ↑ Off-spec particles
- ↑ Gas temperature → ↑ Velocity→ ↑ L-pbf yield
- ↑ Gas pressure → ↑GMR → ↑ L-pbf yield
- Aspiration pressure predictions match exp. Observations
- Simulations → Similar trend to breakup length

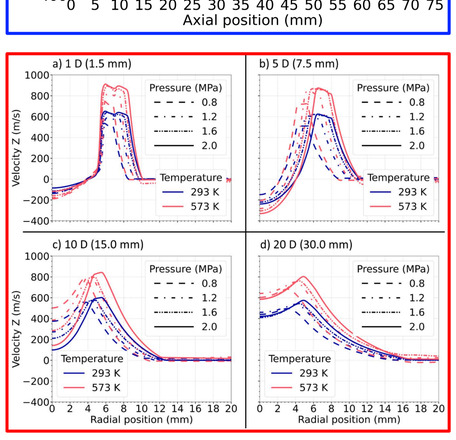
How the atomization affects the metal powder properties?

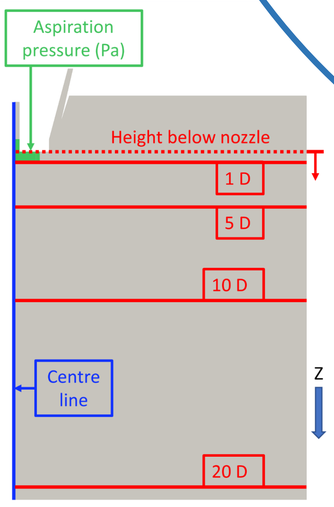


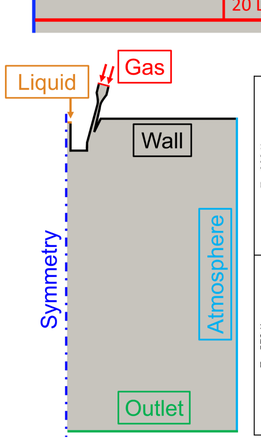
Numerical Simulation





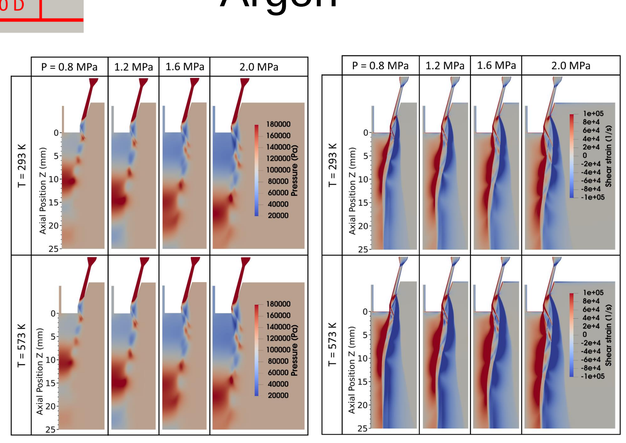




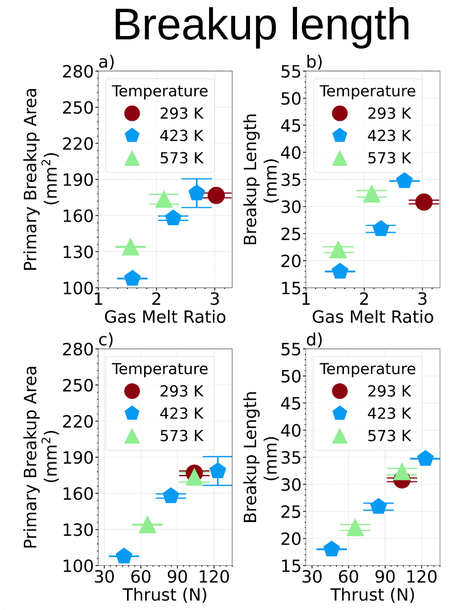


RhoPimpleFOAM

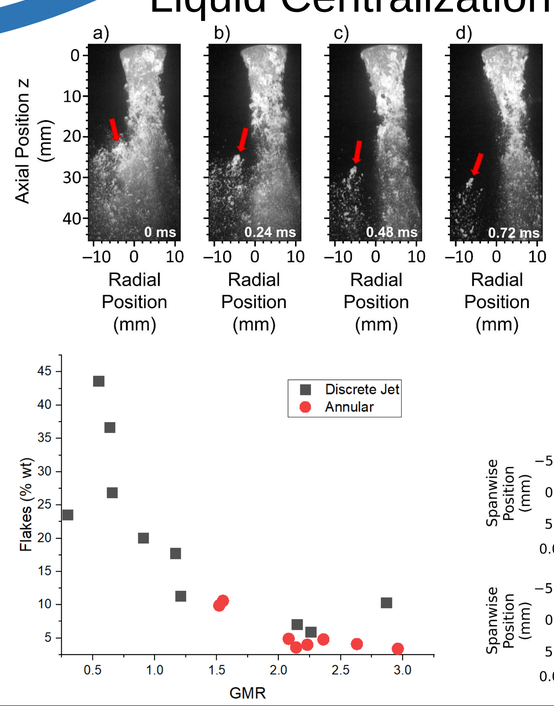
- Compressible
- Transient
- Argon

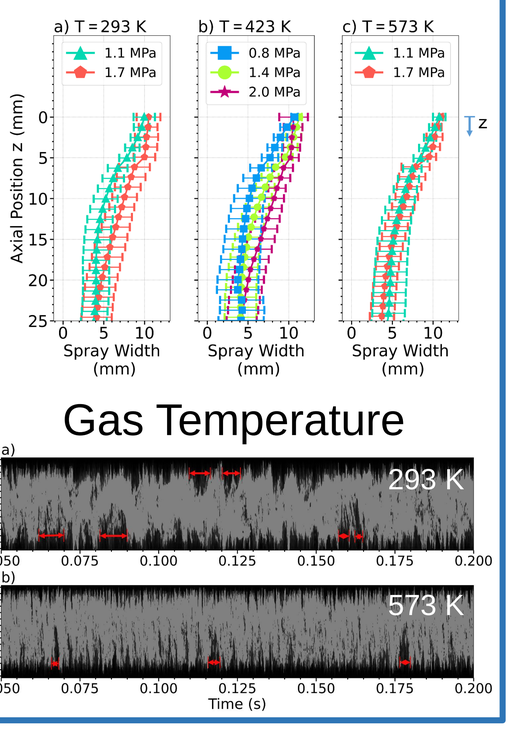


High-speed Imaging



Liquid Centralization





Gas Temperature

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