

Development of a Wire-Feed Metal Deposition Cell

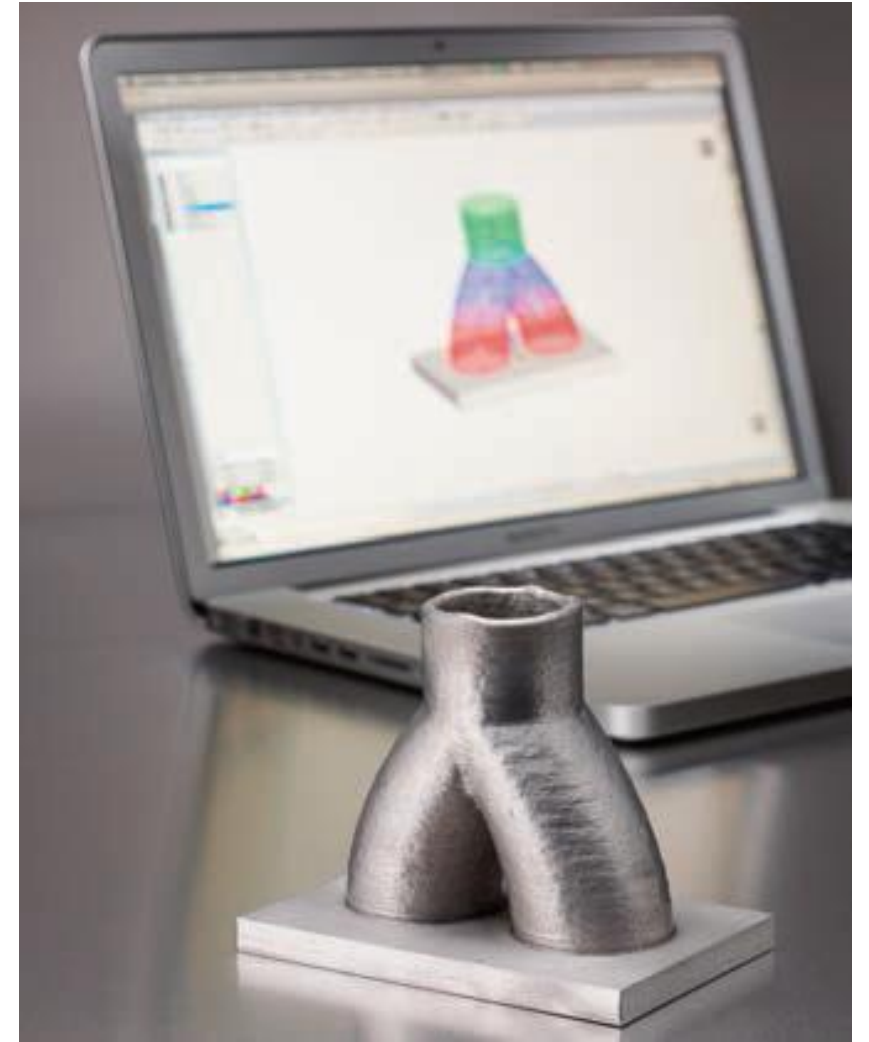
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Mechanical Engineering

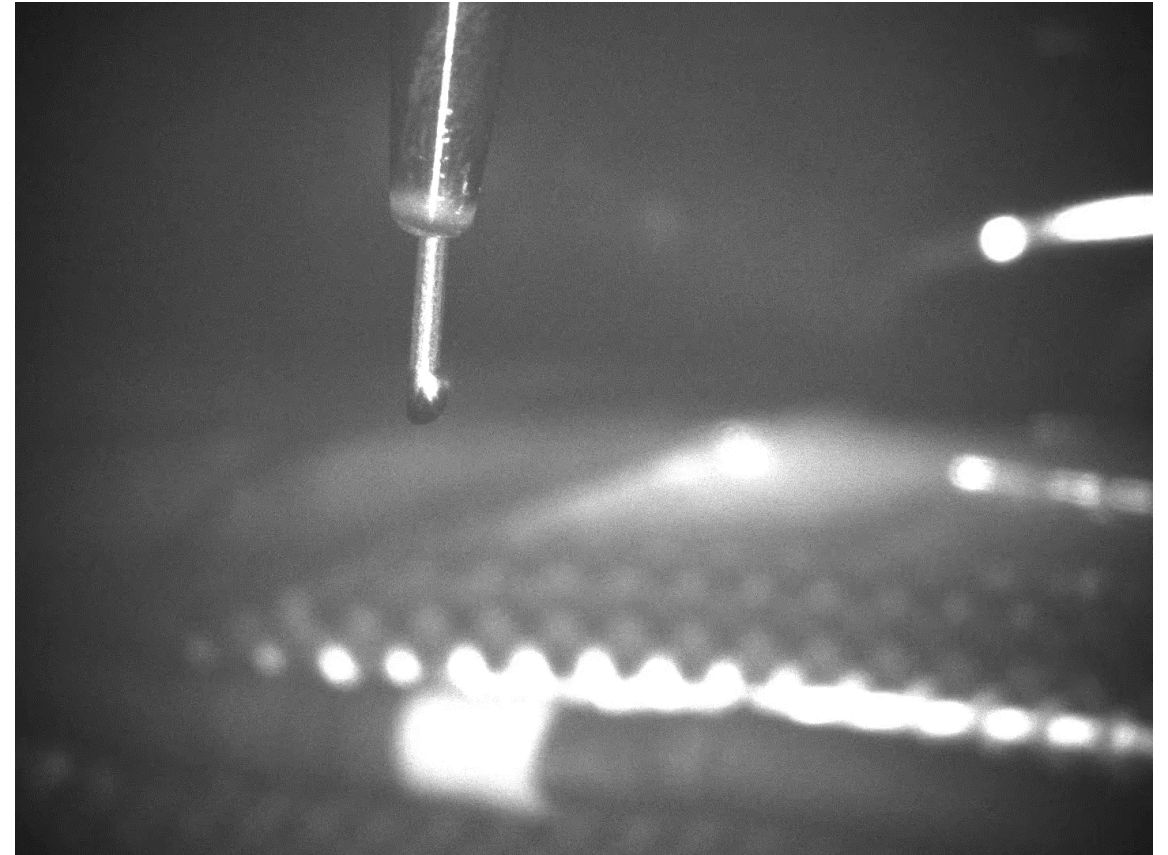
Metal AM

- Creation of complex metal structures for use in many applications and industries
- Advantages over subtractive manufacturing
- Blown-powder, power-bed, wire

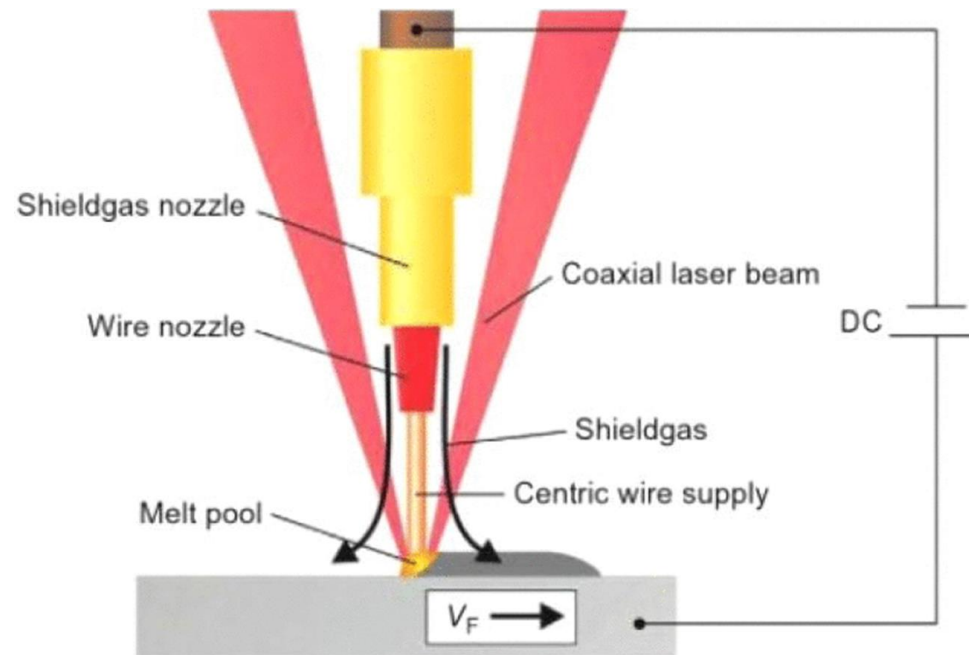
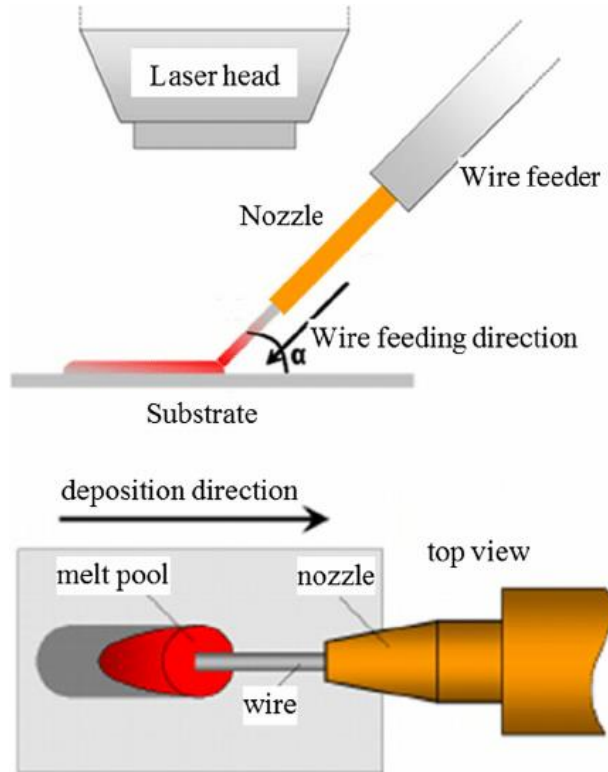


Coaxial Wire-Feed AM

- **Process is similar to:**
 - Plastic filament 3D printing
 - Laser welding
- **Laser used as heat source**
- **Advantages**



Coaxial Wire-Feed AM



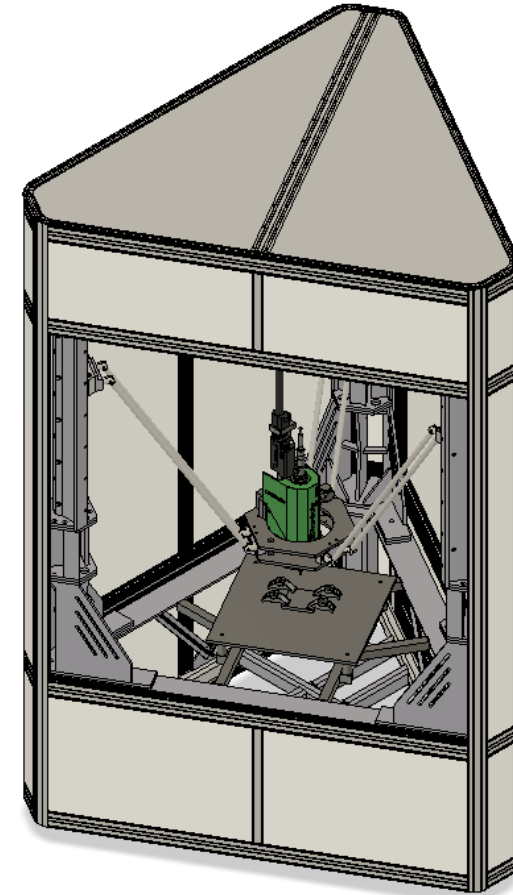
Research Focus

- **Four main avenues**
 - Coaxial wire cell development
 - Process control
 - Mechanical testing methods
 - Process verification



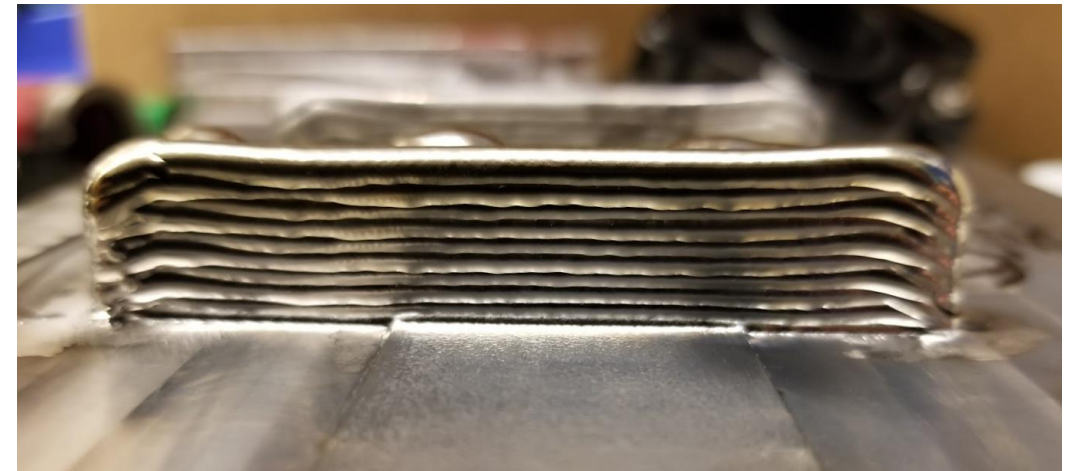
Coax Wire Cell Development

- System design
- Integration of auxiliary equipment
 - Laser, chiller, robot, controls
- Timing of critical deposition events



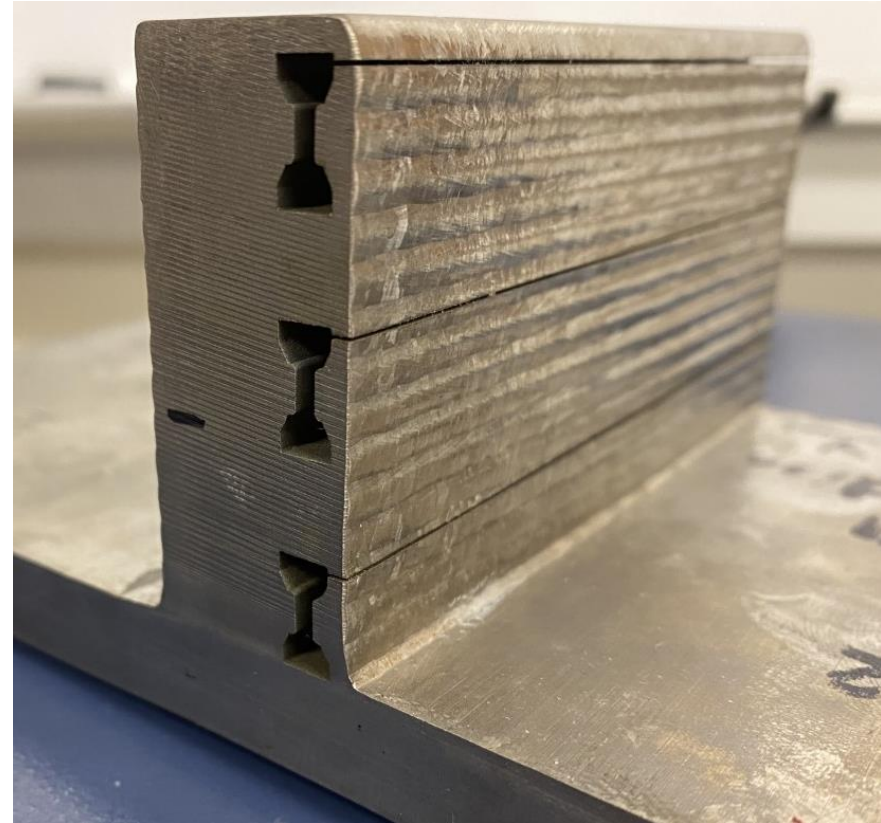
Process Control

- **Heat control**
 - Input constant heat into the deposit for consistent properties
- **Height control**
 - Deposit flat beads regardless of geometry factors



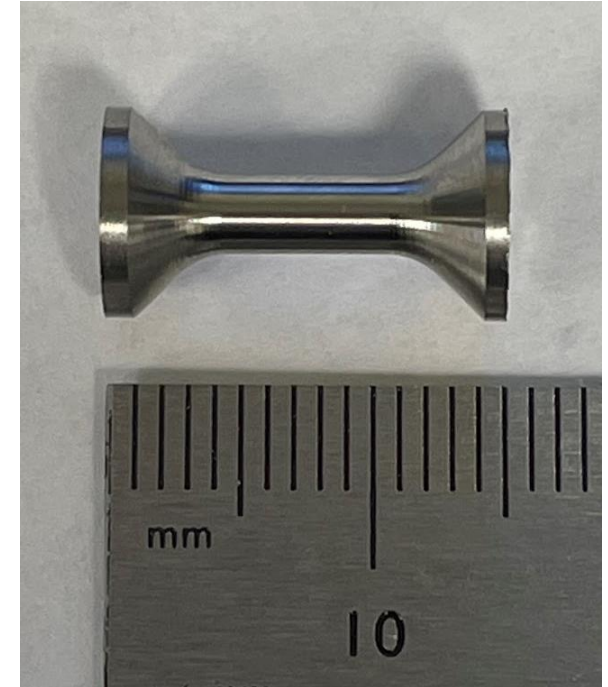
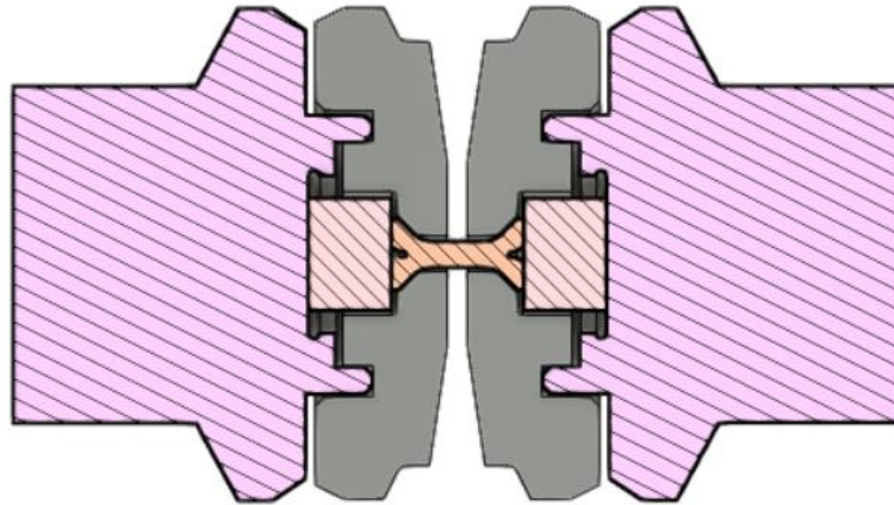
Mechanical Testing

- Mini-Tensile
- Mini-Fatigue
- Micro-CT
- SEM Imaging



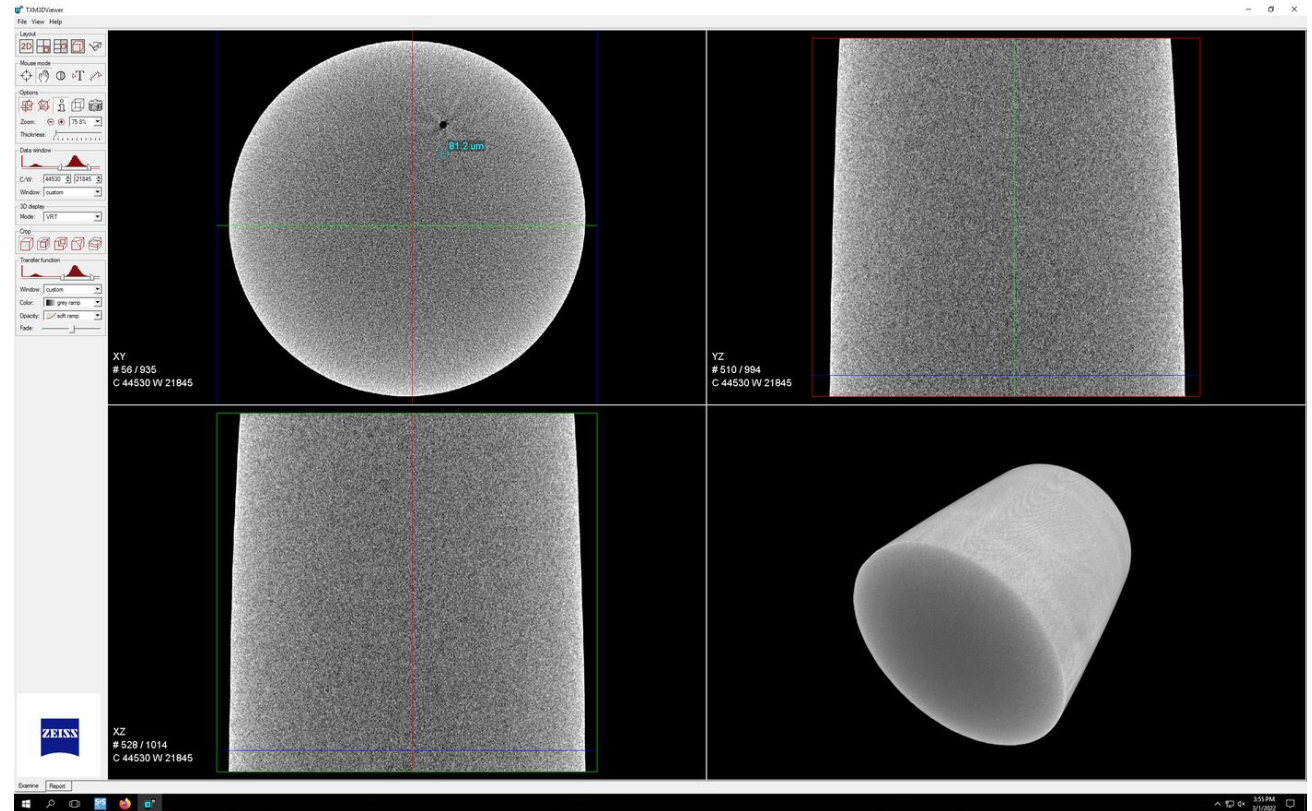
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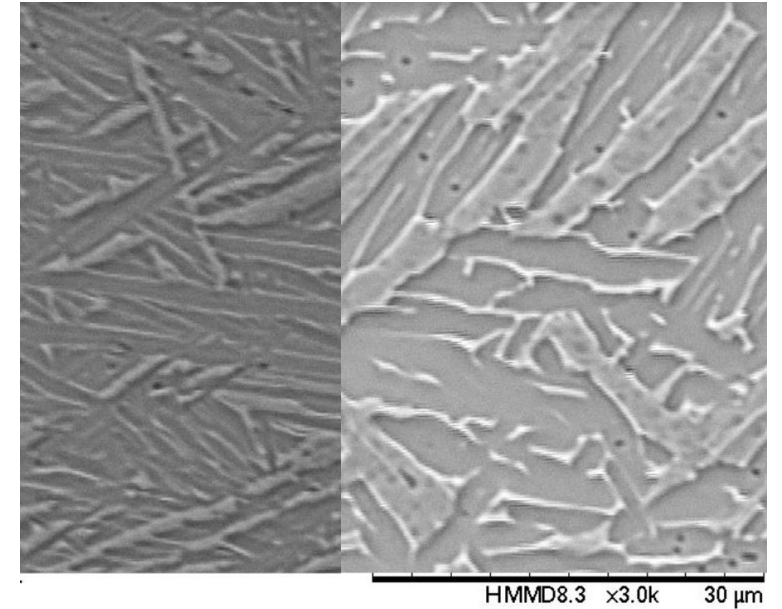
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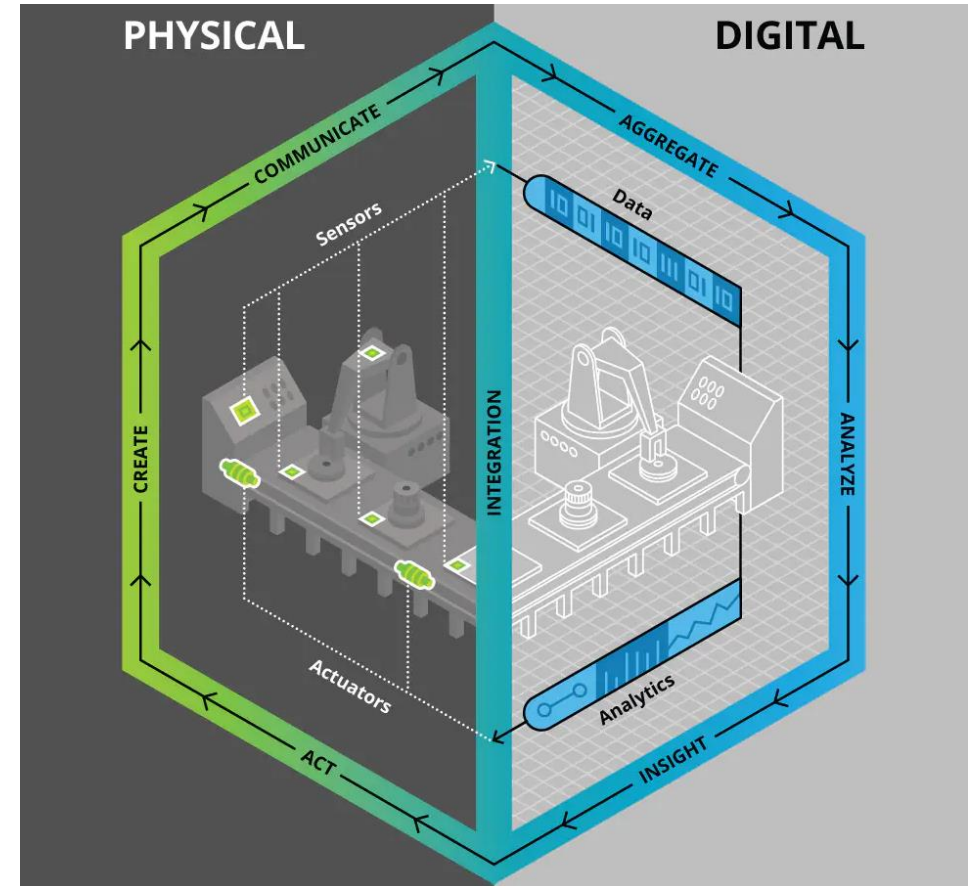
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Process Verification

- Digital twin of the system to inform process parameters based on system data
- Control deposition parameters on the fly for stable deposition and optimal mechanical performance



Relevance

- Fabrication of metal parts with complex geometry and one-of-a-kind components
- Superior mechanical properties vs other processes
- Greatly improved efficiency of manufacturing for tooling, aerospace, and medical industries
- Commercialization of technology and techniques