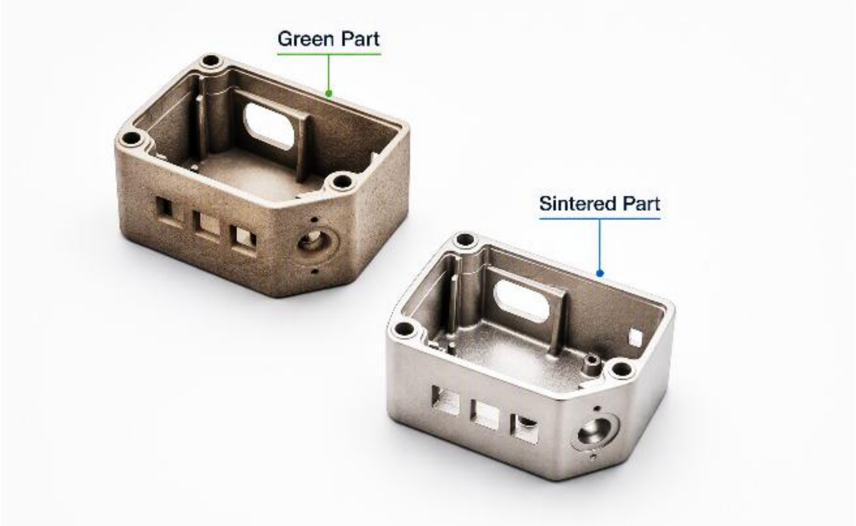
Technology Spotlight

Metal Binder Jetting (MBJ):
Enabling Next-Generation Metal Additive Manufacturing

Dou Yee Technologies (DYT) has developed capabilities in a range of additive manufacturing processes, including Selective Laser Melting/Laser Powder Bed Fusion (SLM/LPBF), Fused Filament Fabrication (FFF), Stereolithography (SLA), and Binder Jetting, enabling the production of components across diverse materials and applications. Through collaborations with A*STAR's Additive Innovation Centre (AIC), National Additive Manufacturing Innovation Cluster (NAMIC), and HP Inc., DYT is establishing an industrial Metal Binder Jet (MBJ) workflow focused on SUS316L and 17-4PH stainless steels for low-volume, high-value production, while expanding into copper for advanced thermal management applications.



DYT's 316L industrial sensor housing product produced using HP Metal Jet S100 at AIC, A*STAR

Why Metal Binder Jetting?

HP Metal Jet combines the principles of powder metallurgy and additive manufacturing to produce complex metal components. Unlike laser-based metal additive manufacturing processes, metal powder is not melted during the printing. Instead, liquid binder is selectively deposited onto successive layers of metal powder to form the green part, which subsequently undergoes curing, depowdering, and sintering to achieve the final metallic component. This approach offers significant advantages, including high productivity, design freedom, and cost-effective manufacturing. Key benefits include several times higher productivity than traditional laser-based metal 3D printing technologies, the elimination of support structures during printing, and compatibility with cost-effective, industry-standard Metal Injection Molding (MIM) powders. The HP Metal Jet S100 system features a build volume of 430 × 309 × 140 mm with layer thicknesses from 35 – 140 µm and multi-level packing for high throughput.

Metal Binder Jetting Workflow

From digital design to final sintered metal part

1 Design & Job Preparation

- CAD model preparation
- Build orientation
- Job setup in HP Build Manager software
- Set print process parameters

2 Powder Preparation

- Pre-bake powder
- Sieving
- Powder loading into build unit

3 Printing

- Printing green parts
- Powder spreading
- Layer-by-layer fabrication
- In-process sensing and controls

4 Curing

- Printed parts are heated
- Solvents are extracted
- Binder is cured
- Builds strength to green part

5 Cooling

- Build volume cooling to room temperature

6 Depowdering

- Depowdering
- Fine cleaning
- Powder recovery and sieving
- Powder recycling
- Retrieve green parts

7 Sintering

- Thermal debinding
- Sintering for density and mechanical properties

Metal Binder Jet Workflow – From CAD File to Sintered Part (Images courtesy of HP Inc.)

Metal Binder Jet Development Program

Advancing Metal Binder Jetting Together

JOINT DEVELOPMENT

Joint development initiative between AIC, NAMIC and HP to validate MBJ manufacturing workflows

INITIAL MATERIAL FOCUS

SUS316L and 17-4PH

TARGET APPLICATIONS

Low-volume/high-value industrial, medical, semiconductor and precision engineering components

FUTURE MATERIAL ROADMAP

Copper
Nickel Superalloys
Hard Metals

Material Roadmap

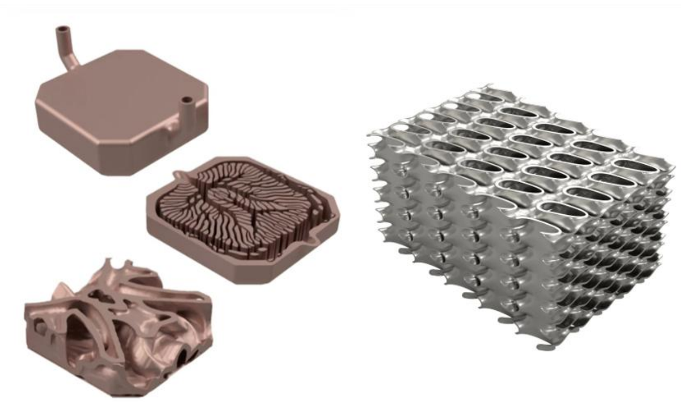
Material	Status	Typical Applications
SUS316L	Qualified	Medical, Semiconductor, Industrial
17-4 PH	Qualified	High-Strength Precision Parts
Copper	Evaluation	Heat Sinks, Cold Plates, Heat Exchangers, Thermal Management
Nickel Superalloys	Future Development	Turbomachinery, Aerospace
WC-Co	Future Development	Wear Parts, Tooling

Ideal Applications for Metal Binder Jetting

Copper Binder Jetting

A Strategic Opportunity

AI data centres are driving growing demand for advanced thermal management solutions to address increasing heat loads. HP's production partner has demonstrated the fabrication of copper heat sinks and liquid cold plates featuring complex internal flow channels optimized for thermal performance. Reported development data indicates that binder-jetted copper can achieve densities of approximately 8.2 g/cm^3 in the as-sintered condition and near-full density of 8.9 g/cm^3 following hot isostatic pressing (HIP). Correspondingly, thermal conductivity increases from around 315 W/m·K to approximately 365 W/m·K after HIP, while electrical conductivity approaches 97% IACS. The design freedom enabled by MBJ allows for optimized flow paths that enhance heat transfer efficiency while reducing pressure drop, making MBJ technology attractive for next-generation thermal management.



	COPPER (AS-SINTERED)	COPPER (HIP)
DENSITY	8.2 g/cm^3	8.9 g/cm^3
THERMAL CONDUCTIVITY	315 W/mK	365 W/mK
ELECTRICAL CONDUCTIVITY	85 IACS	97 IACS

Advanced copper heat exchangers and heat sinks for thermal management. (Images courtesy of ToffeeX)

Why Partner with DYT?

- **Extensive MIM/CIM production expertise and sintering know-how.**
- Established collaborations with **AIC, NAMIC** and **HP.**
- Strong **design-for-additive** and **design-for-sintering** capability.
- Capability to **transition prototypes into production** using the most economical manufacturing route.

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