



# Asgaard Metals

Circular Production of Billets & Powder

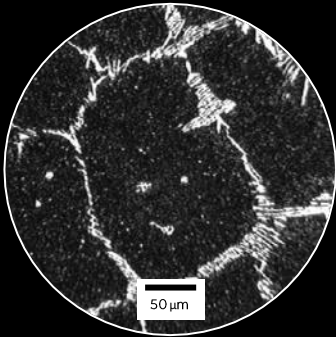
#ToolSteel  
#Circularity  
#AdditiveManufacturing

Spray Forming Technology

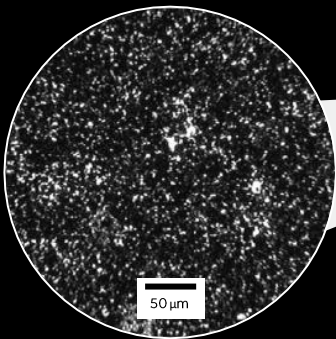
# Answering customer needs through Advanced Technology

Asgaard Metals offers three different Spray Formed Steels: ODIN13 (1.2344 / H13), ODIN2 (1.2379 / D2) and ODIN44 (1.4125 / 440C). Typically, our tool steels show 3-5 times better wear resistance, improved toughness and hardness in comparison to conventional steels of the same grade – ultimately leading to a longer lifetime of your applications.

## Conventional D2 / 1.2379



## Spray Formed ODIN2

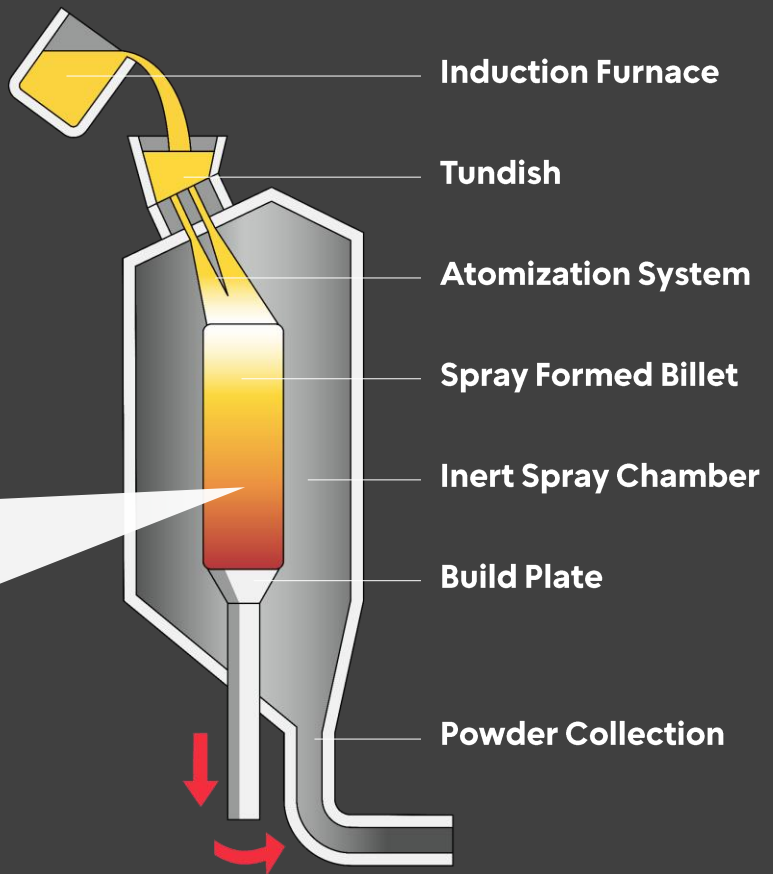


Conventional vs. Spray Formed microstructure of D2 / 1.2379.

Conventional casting techniques result in coarse grains with brittle carbide networks.

Spray Forming results in segregation-free & uniform microstructures with fine grains & finely dispersed carbides.

## Spray Forming Technology



In Spray Forming, liquid steel is atomized into fine droplets which are directly deposited onto a rotating build plate. Unlike in Powder Metallurgy (PM) the billet is gradually built up without Hot Isostatic Pressing (HIP). The billet can then be forged or rolled into the desired dimensions & shapes (e.g. bars & plates).

**Next generation crack- and wear-resistant cold work steel.**

**ODIN2**

1.2379 / AISI D2

**Cold Work Tool Steel**



**Composition (max. wt.%)**

C	Si	Mn	Cr	Mo	V
1.5	1.0	1.0	12.0	0.95	1.0

**Applications**

- Cold rolls
- Forming rolls
- Knives
- Engineering applications

**Benefits**

- High wear resistance
- Excellent compressive strength, toughness and through hardening properties
- Dimensional stability in hardening and in service
- Good resistance to tempering back

**Case Study**

Company: American  
 Work material: Fabric  
 Tool dimension: Ø 254 mm

	Convent. AISI D2	ODIN2
Production	34 million	84 million
Condition	Micro cracks	No indications of micro cracks

*Spray Formed steel is available in different dimensions suiting your application including bars, plates, rounds and powder.*



**All-round hot work tool steel.**

**ODIN13**

1.2344 / AISI H13

**Hot Work Tool Steel**



**Composition (max. wt.%)**

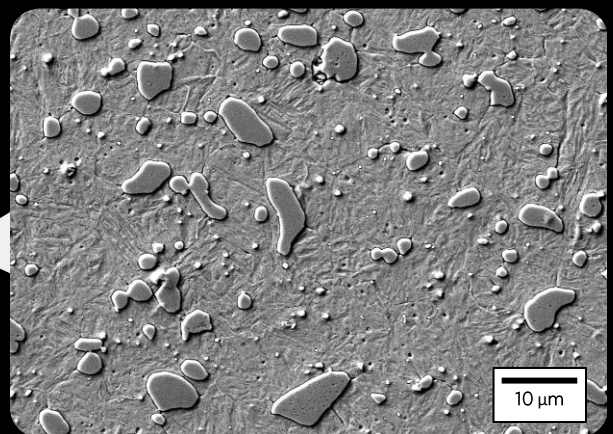
C	Si	Mn	Cr	Mo	V
0.39	1.0	0.4	5.2	1.4	0.9

**Applications**

- Injection molds
- High pressure die casting molds
- Hot stamping tools
- Extrusion tools
- Engineering applications

**Benefits**

- Ease of machining
- Good EDM properties
- Excellent polishability
- Improved toughness
- Longer tool life
- Reduced carbon footprint



*High resolution SEM image of ODIN2 microstructure after hardening. Uniformly distributed small carbides (<10 µm) increase wear resistance. The carbides' round morphologies prevent micro cracking resulting in an increased life time.*

**Versatile stainless tool steel with minimal carbon footprint.**

**First printable high carbon tool steel in the LPBF market.**

### ODIN44

1.4125 / AISI 440C

Stainless Tool Steel



#### Composition (max. wt.%)

C	Si	Mn	Cr	Mo	V
1.2	1.0	1.0	18.0	0.75	-

#### Applications

- Food processing tools
- Knife blades
- Surgical instruments
- Bearings, valves & gears
- Dies & injection molds

#### Benefits

- High wear & corrosion resistance
- Excellent compressive strength, toughness & through hardening properties
- Dimensional stability in hardening & in service
- Minimal carbon footprint

### THOR44

1.4125 / AISI 440C

Additive Manufacturing



#### Composition (max. wt.%)

C	Si	Mn	Cr	Mo	V
1.2	1.0	1.0	18.0	0.75	-

#### Applications

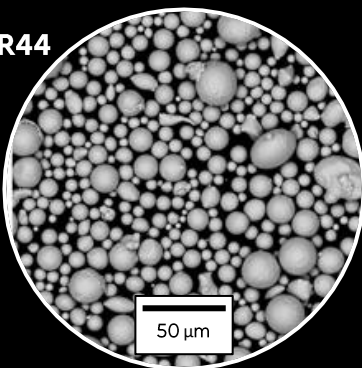
- Food processing tools
- Knife blades
- Surgical instruments
- Bearings, valves & gears
- Dies & injection molds

#### Benefits

- Hardest LPBF tool steel on the market with up to 63 HRC
- Ease of printing
- High corrosion resistance
- No cobalt & nickel
- ~50% higher thermal conductivity compared to M300 / MS1 / 1.2709
- Minimal carbon footprint

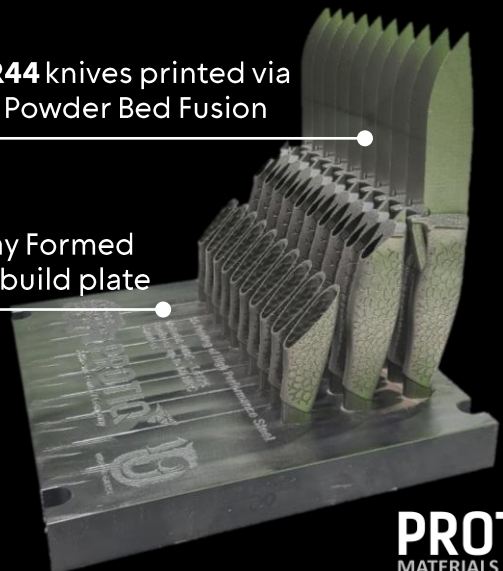
**ODIN44 & THOR44** are produced in the same process resulting in superior resource efficiency & chemical compatibility for Hybrid Additive Manufacturing applications.

### THOR44



**THOR44** knives printed via Laser Powder Bed Fusion

**ODIN44** Spray Formed & machined build plate



Powder available in  
 0–25 µm for Binder Jetting  
 25 – 63 µm for Laser Powder Bed Fusion  
 63 – 120 µm for Laser Cladding.



# Circular Production

Closed loop recycling

Up to 90% reduction in CO<sub>2</sub>

***“Metal production is the biggest single cause of global warming” – Raabe, 2023***

**Spray Forming** exhibits significant potential in terms of carbon footprint reductions. Its minimized material waste & efficient use of resources aligns with sustainable manufacturing ideals. At the same time, the method enhances material attributes & lifetime establishing it as a pivotal approach for crafting high-performance elements spanning diverse sectors.



# About Asgaard

Asgaard Metals boasts the world's largest Spray Forming plant using a patented technology to produce both steels and powders for Additive Manufacturing.

Asgaard Metals heritage goes back to 1923 with an origin as a traditional Black Smith company. The original Black Smith company – Nordisk Staal – is today a sister company to Asgaard Metals.

Asgaard Metals vision is – besides delivering world class quality steels and powders – also to deliver turn-key Spray Forming production plants to locally recycle and upgrade steel more efficiently. Having a 100% closed loop production ensures a 90% reduction in CO<sub>2</sub> foot print and a security in supply.