AUBERT&DUVAL

Nickel-based alloy

MPN

POWDER
FOR HIPPED PARTS

> TYPICAL COMPOSITION (weight %)

C	Co	Ni	Cr	Mo	Al	Ti	Fe
< 0.020	15,7	Base	11,5	6,5	4,35	4,35	0,5

> PHYSICAL PROPERTIES

Density (g/cm^3):

- 7.99

> PHYSICAL METALLURGY

MPN alloy has an austenitic matrix structure. High temperature strengthening is produced by the precipitation of the ordered intermetallic gamma prime phase, $Ni_3(Al, Ti)$, and by solid solution hardening principally by molybdenum. Heat treatment therefore comprises partial solutioning slightly below the gamma prime solvus temperature (~1195°C), followed by rapid cooling and subsequent aging, in order to control the size and distribution of the γ' precipitates.

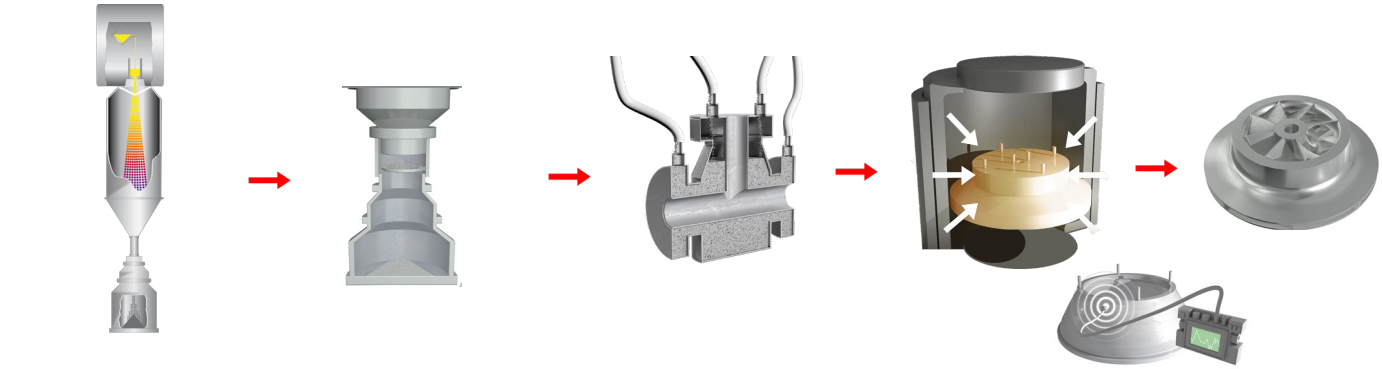
> APPLICATIONS

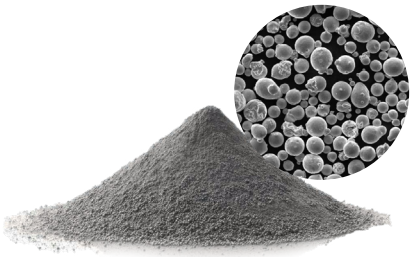
MPN alloy is employed for components demanding a high yield strength above 700°C, or a combination of high yield strength and good corrosion and oxidation resistance up to temperatures of more than 1000°C.
Typical applications are therefore:

- Highly stressed static and rotating components, such as disks and wheels,
- Components such as diffuser nozzles, requiring high yield strength and excellent corrosion resistance up to 1050°C.
- Tools for forging and isothermal forging process

> PRODUCTION ROUTE

POWDER ATOMIZATION ▶ SIEVING & POWDER QUALITY CONTROL ▶ CAPSULE FILLING/ DEGASSING ▶ HOT ISOSTATIC PRESSING ▶ HEAT TREATMENT (OPTIONAL)





MPN powders

MPN hipped bars or parts examples

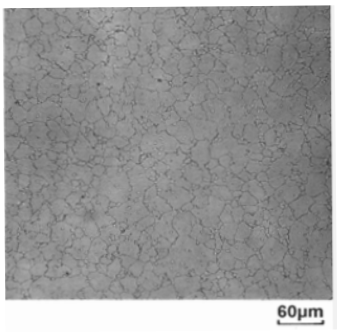
> TYPICAL MECHANICAL PROPERTIES

Different final properties depending on heat treatment and microstructure.

THIN GRAIN SIZE FOR STRENGTH & FATIGUE RESIGTANCE

As HIP

HIP + Specific Heat Treatment

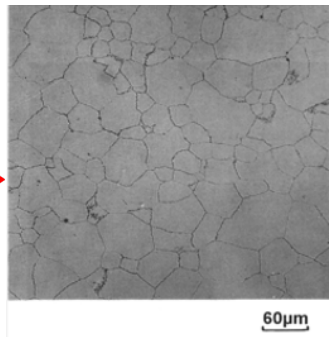


Thin grain size **8-12 ASTM**

	Tensile Test				Grain size (ASTM)	Hardness (HRC)
	UTS (MPa)		YS0.2 (MPa)	Elongation (%)		
As HIP	20°C	>1340	>780	>15	8 to 10	35 / 39
HIP + Specific Heat treatment	20°C	>1410	>960	>13	10 to 12	37 / 40
	700°C	>1200	>800	>15		

LARGE GRAIN SIZE FOR CREEP RESISTANCE

Pre-Heat treatment + HIP + Specific Heat Treatment



Large grain size **4-6 ASTM**

Tensile Test				Grain size (ASTM)	Hardness (HRC)
UTS (MPa)		YS0.2 (MPa)	Elongation (%)		
20°C	>1300	>850	>20	4 to 6	35 / 39
700°C	>1100	>700	>30		-

> ADVANTAGE OF MPN POWDER METALLURGY SOLUTION

- Reduction of chemical microsegregation
- Homogenous microstructure
- Reduction of grain size.

- Isotropic properties
- High yield strength and fatigue at high temperature
- Better crack propagation resistance

- Flexibilities in delivery quantities and short lead time.
- Possible to have semi-finish shape close to the final part = Reduction of machining operation.
- Part weight possible between 1 to 1000 kg

Aubert & Duval - 11/2025