AUBERT&DUVAL

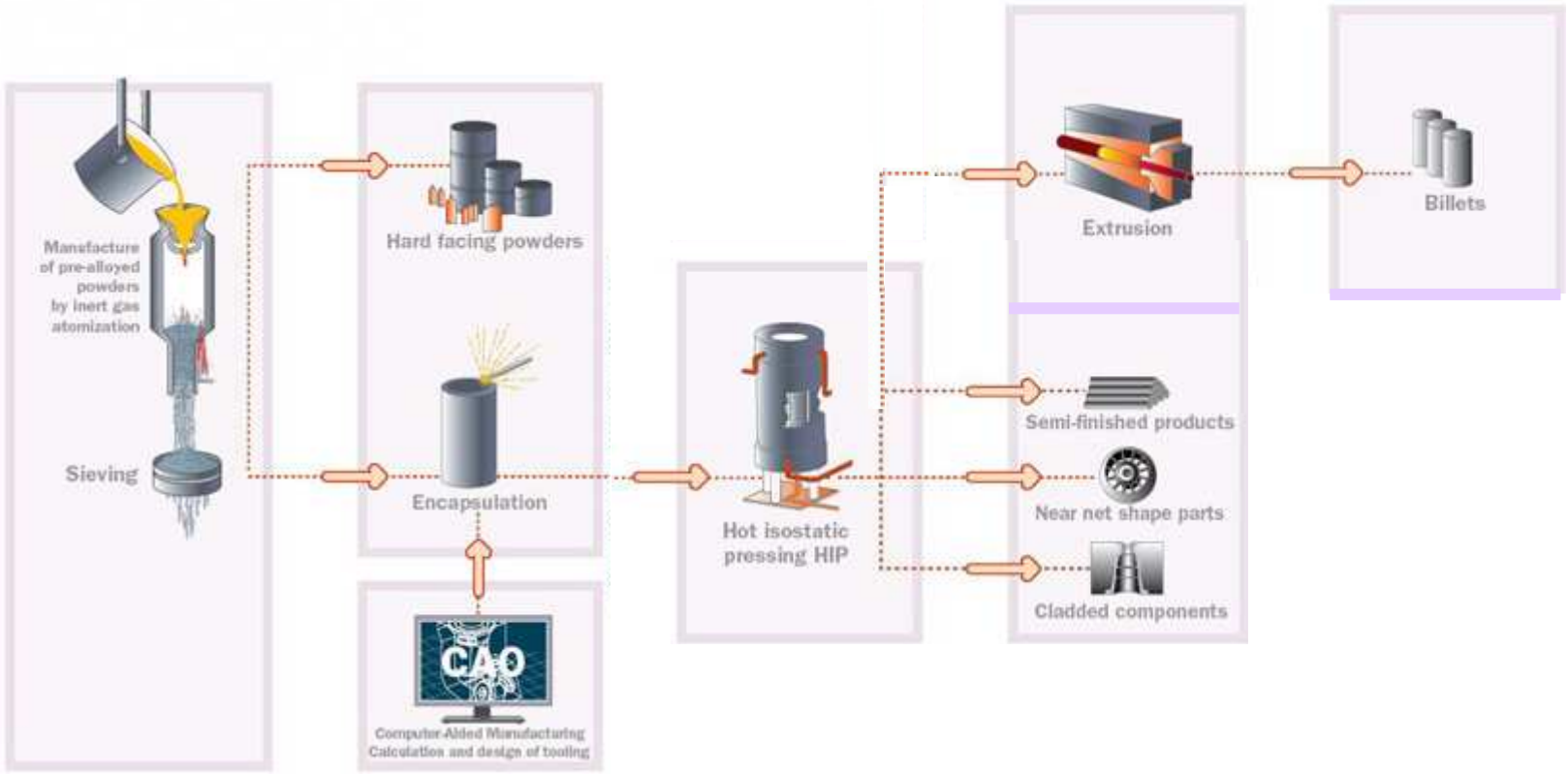
PM HIP
Near Net Shape Components

IF/TR2.08

a member of ERAMET

AUBERT&DUVAL

Powder metallurgy process route



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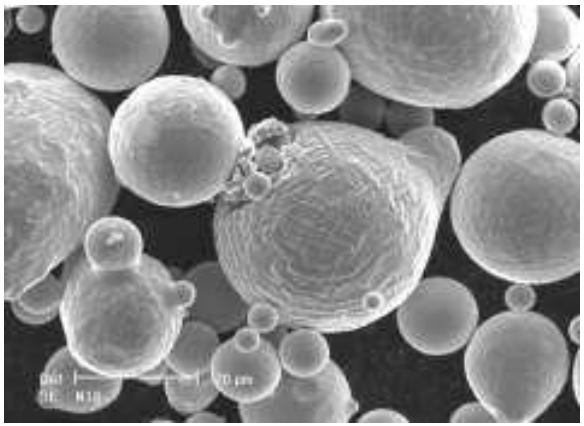
PM HIP NNS process route

1. Customer needs' assessment and choice of material
2. Container design optimization and manufacturing
3. Material melting
4. Powder atomization
5. Powder filling and container sealing
6. HIP consolidation
7. Post – Heat treatment
8. Container removal (by machining or pickling)
9. Inspection (NDT, mechanical testing…)
10. Final Machining

The 6 powder units of Eramet Alloys:
World's largest gas-atomized powder production capacity

Imphy
France



Söderfors
Sweden

Medium tower	VIM tower	R&D tower	Plasma rotating electrode	Dvalin™ tower	Flexiplant™ tower	New Durin™ Tower *(on-going)*
1500 kg	350 kg	35 kg	40 kg	5 - 10 tons	1000 kg	5 - 10 tons
All	Super-alloys	All	Tita-nium	High speed steels & Tool steels Stainless steels, low alloyed steels Ni-base, Co-base		

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IMPHY PRODUCTION FACILITIES

GAS ATOMISATION

- Open air induction furnace 1500 KG (N_2 gas pressure)
- Vacuum induction furnace 350 kg (Ar gas pressure)
- Induction furnace 35 kg pilot unit / R&D (inert gas protection – Ar or N_2 gas pressure)

PLASMA HEATED ROTATING ELECTRODE PROCESS

Titanium powder production / Shot peening

CLEAN ROOM (10000 class)

Sieving and conditioning equipments ➲ aircraft engine components

SIEVING AND CONDITIONING UNITS

WELDING, FILLING, EVACUATING EQUIPMENTS FOR ENCAPSULATION (BEFORE HIP)

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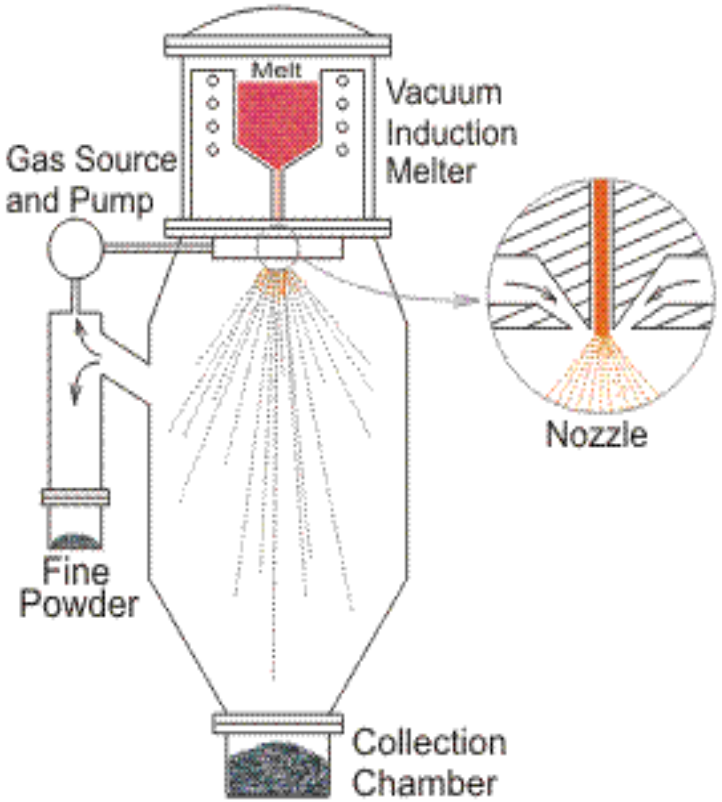
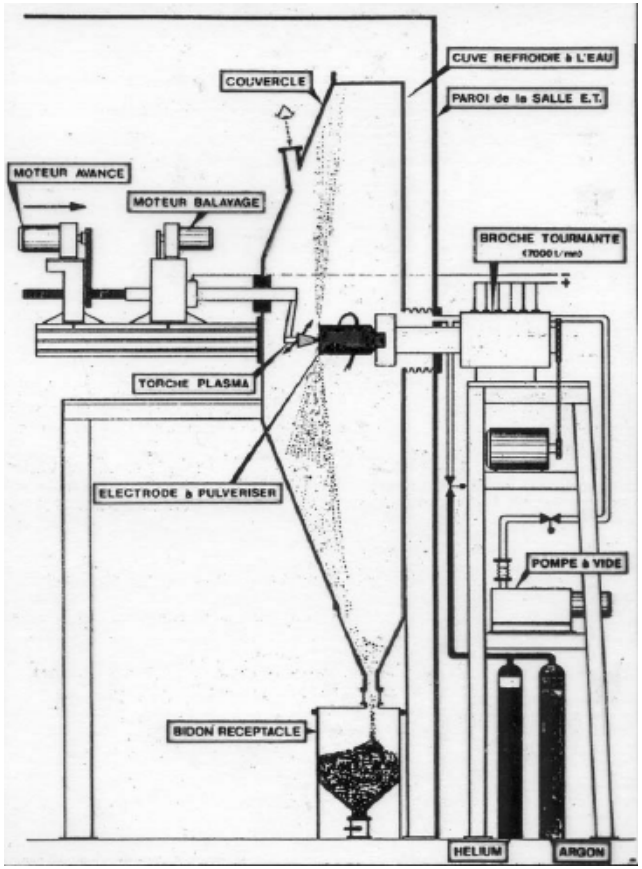
IMPHY PROCESSES (1)



GAS ATOMISATION PROCESS



PLASMA HEATED ROTATING ELECTRODE PROCESS for Titanium alloys

A&D PM HIP Part Capability

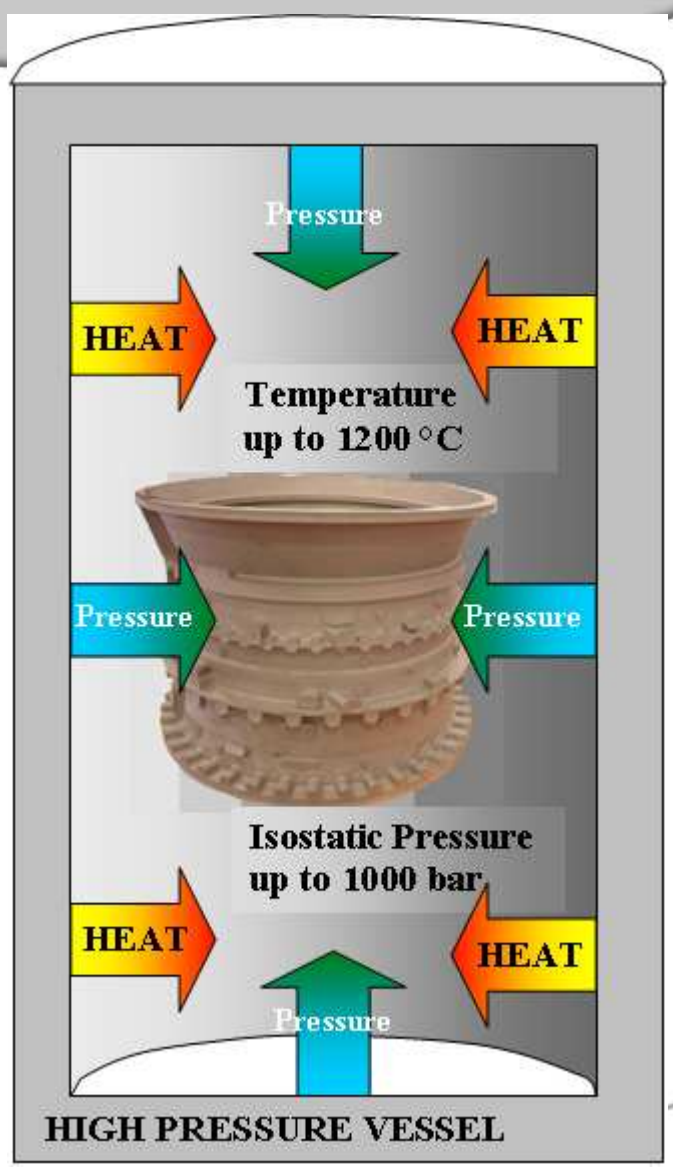
Series Typically 1 to 10 000 units (depending on part weight)

Part weight up to 15 tons

Shape constraints linked to HIP chamber dimensions

- Option 1: Ø 1150 mm, H 2500 mm
- Option 2: Ø 490 mm, H 850 mm
- Option 3: Ø 340 mm, H 1000 mm

➔ larger sizes available on request



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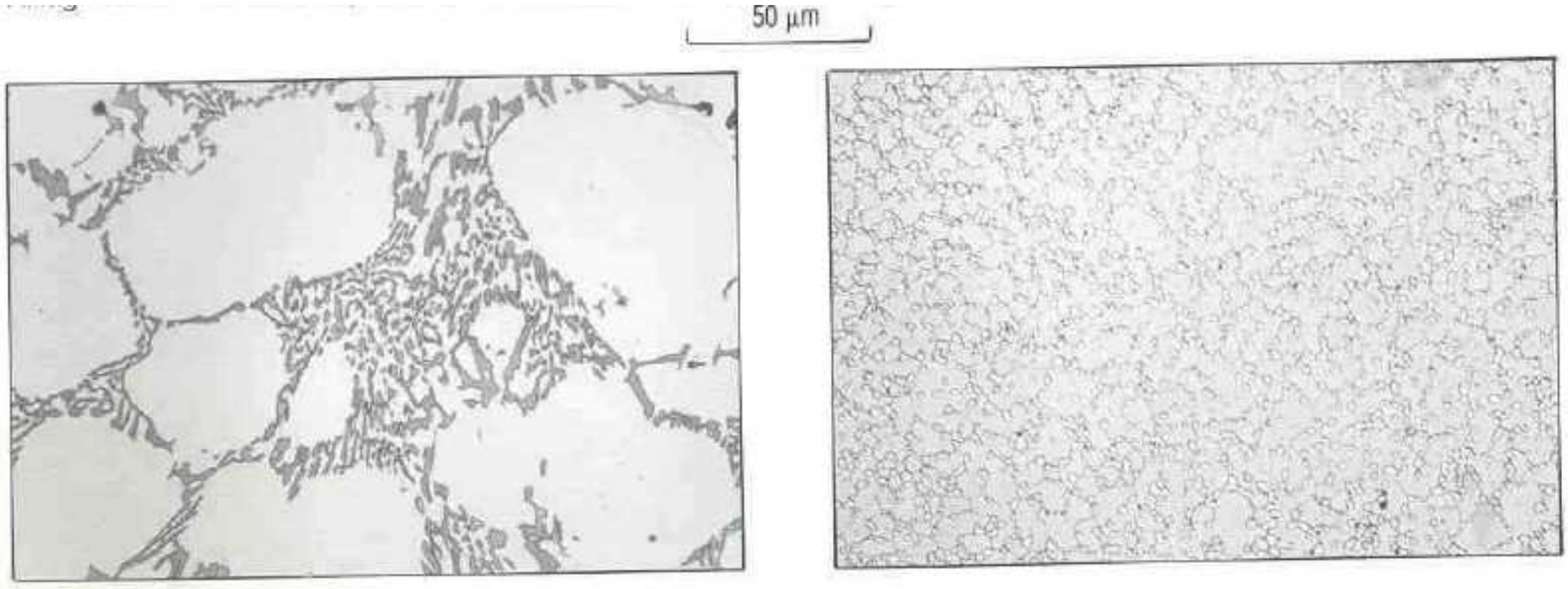
Key benefits of PM HIP technology

- Finer and isotropic microstructure
- Higher alloy content possible
- Good dimensional precision
- Possibility to allocate functional characteristics to specified areas
- Reduced machining
- Less welds and easier NDT inspection
- Leadtime reduction
- No loss of materials

Key benefits of PM HIP technology: A fine & uniform microstructure

Cobalt-base alloy



Cast

PM HIP

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Powder Alloys
Standard Offer

PM-Nickel base alloys
PM 625 (PER 625)
PM 690 (NY 690)
PM N18
PM SYP3

PM-Cobalt base alloys
PM Co6 (Alacrite 602)
PM Co21 (SY 21)

PM-Titanium Alloys
TA6V

Other alloy compositions on specific request

PM-Stainless Steels
PM 440
PM 304
PM 316 (L,N)
PM Type 254 SMO®, UNS S31254

PM-Duplex Steels
PM 318 (type Duplex 2205)
PM 327 (type Super Duplex 2507)

PM-Tool Steels
PM D2 (Sancy 2)
PM D7
PM H13 (SMV4)

PM-High Speed Steels

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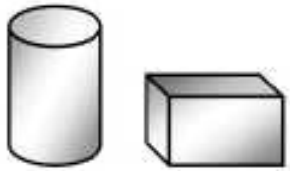
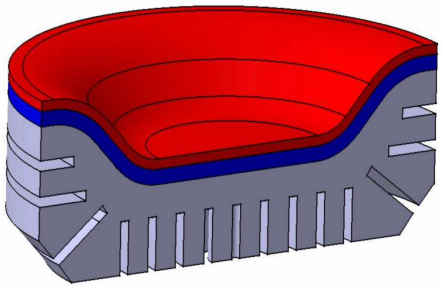
Types of parts produced by the PM HIP technology



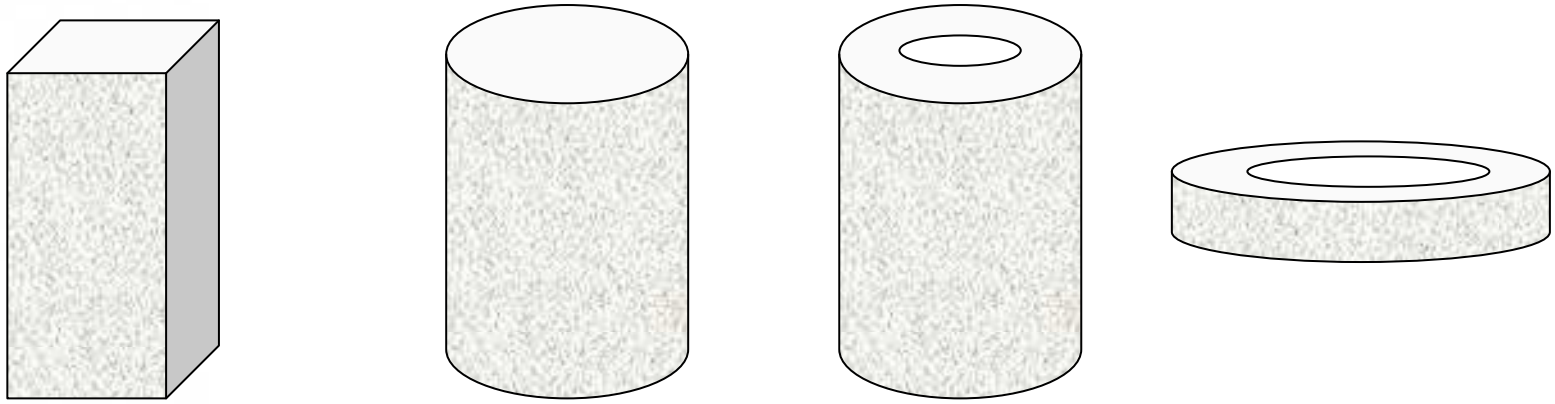
PM HIP Semi-finished products
Further machined
or forged/rolled

PM HIP Near Net Shape components



PM HIP Multilayer components

Shape examples:
Semi-finished products



Flat bar | Round bar | Tube | Ring

- Further machined
- Or forged and rolled

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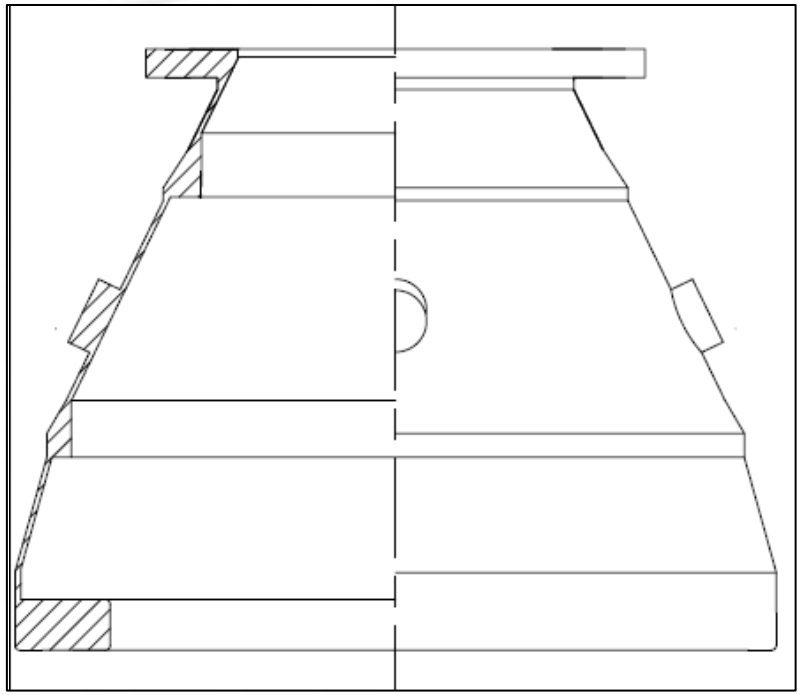
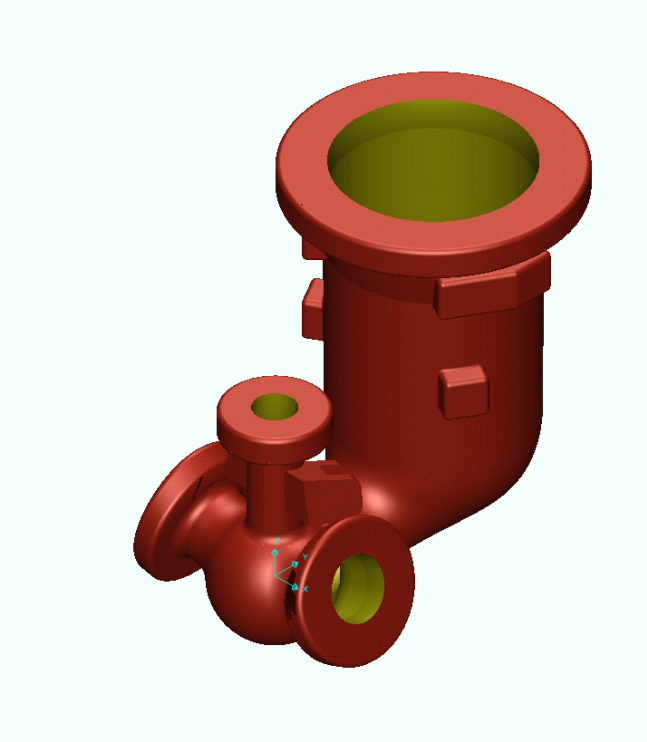
Shape examples:
Near Net Shape parts



Prototype of aircraft engine casing



Prototype of space rocket component

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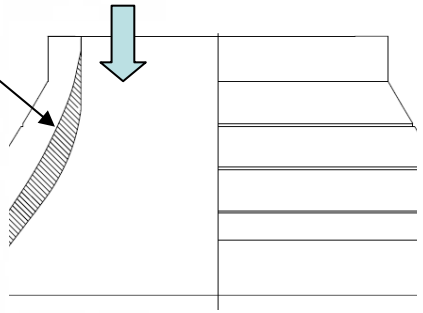
Shape examples: Bimetal parts

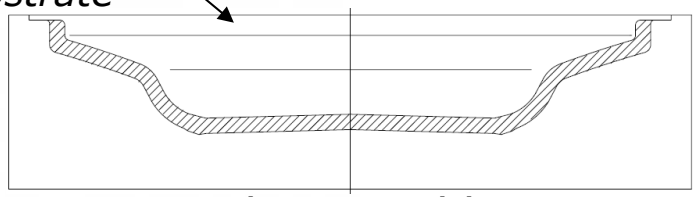
Stone flow

Tool steel powder on a Mn steel substrate

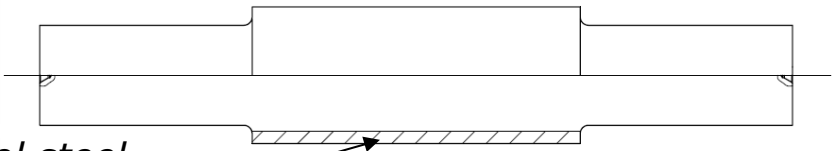


Bimetal Cone crusher

NiBSi powder on a steel substrate



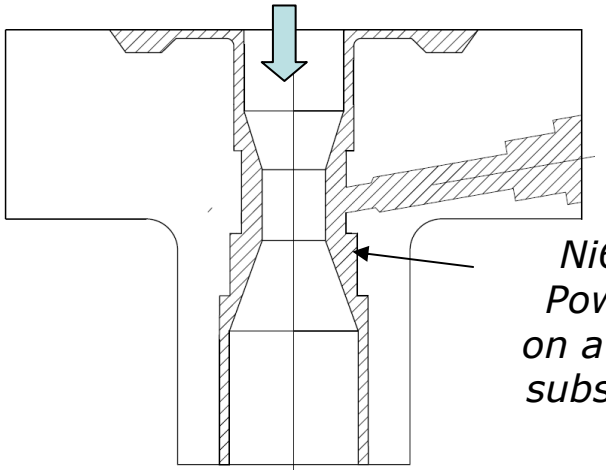
Glass mould



Tool steel powder on a steel substrate

Roll for stainless steel sheet rolling

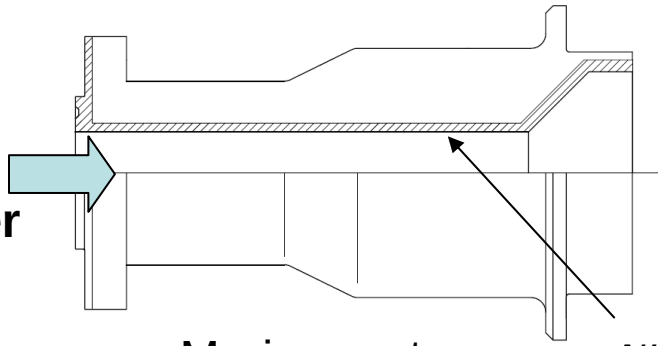
Oil flow



Ni625 Powder on a steel substrate

Bonnet for oil and gas industry

Sea water



Marine part

Ni625 Powder on a steel substrate

PM HIP parts manufactured by Aubert & Duval Photo gallery

Semi-finished and Near Net Shape Components

N18 billets for the production of turbine discs by isothermal forging

TA6V impeller for space rocket

Tooling

Multilayer parts

Stone crusher

Marine component

Multilayer glass mold