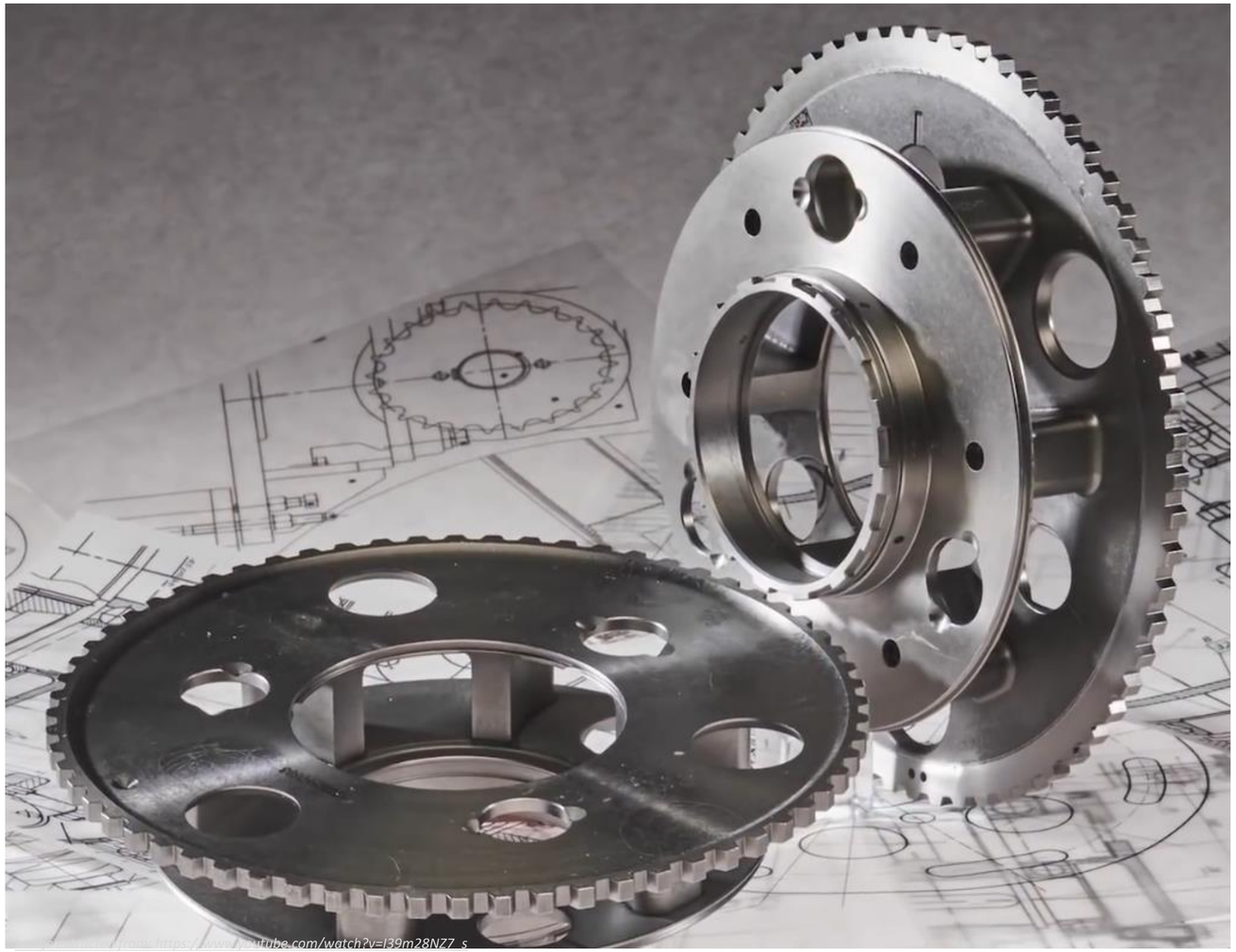
Module 7. An Introduction to Powder Metallurgy



Extracted from: https://www.youtube.com/watch?v=q7fE343QYP4

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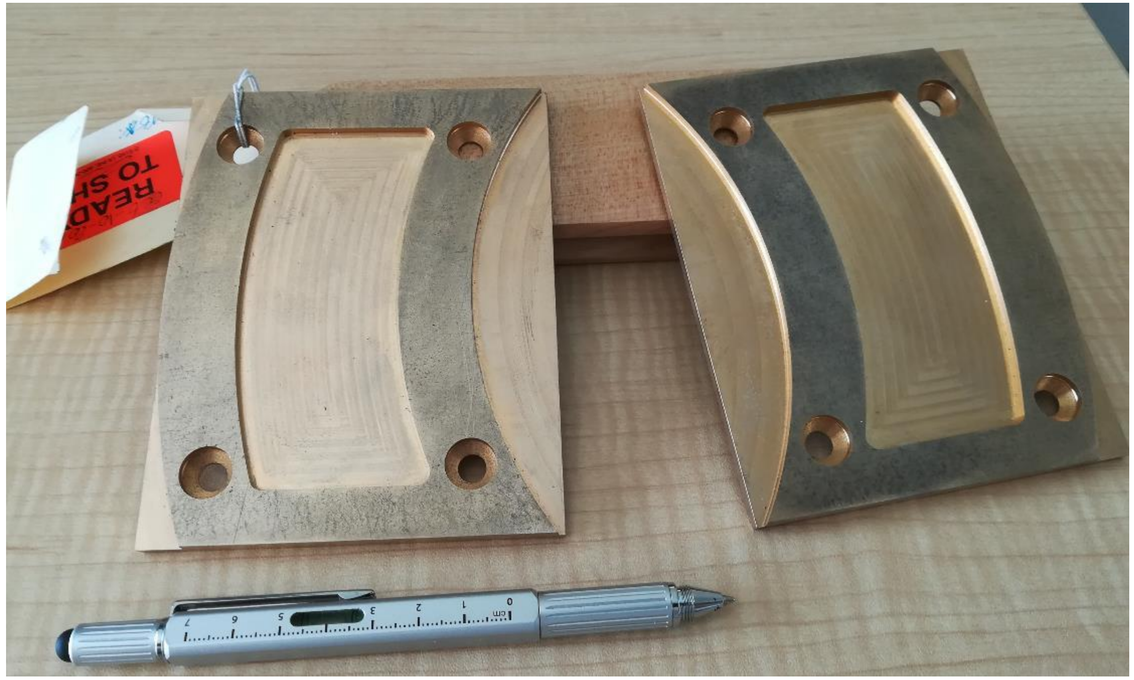

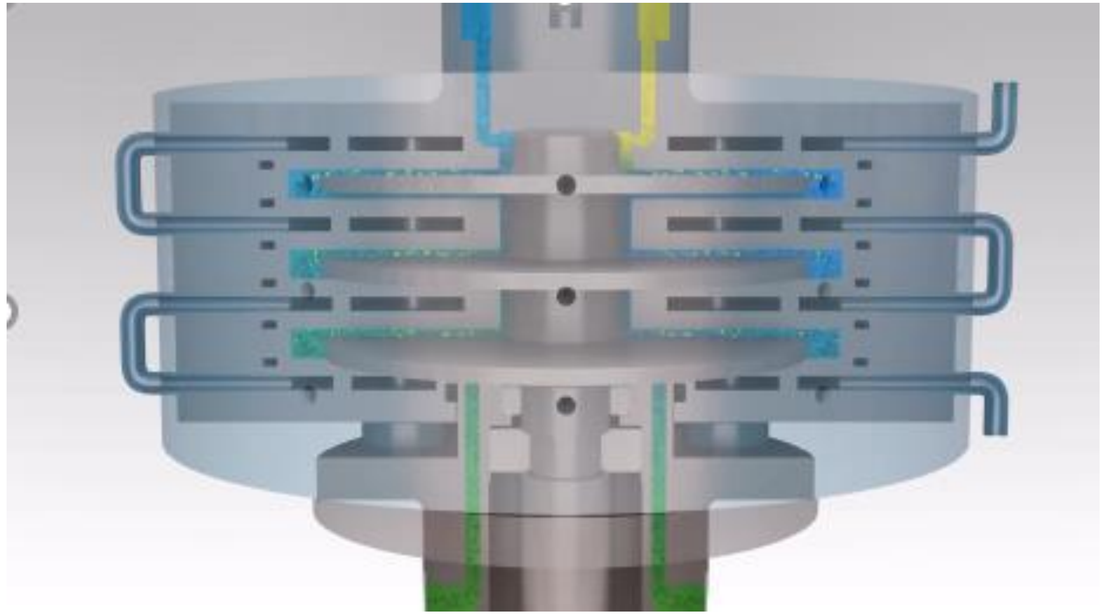

Self Lubricant Material, Porous Oil-Impregnated Bronze

(Bearing Pad for High Speed Rotating Disks)

WHAT MANUFACTURING OPTIONS DO WE HAVE TO MAKE THIS?

A Complex Part in a Spherical Parallel Robot

EXAMPLE OF PM PARTS

Car Connecting Rod

Parts in Automotive Carrier System, and Clutches

Extracted from: https://www.youtube.com/watch?v=q7fE343QYP4

EXAMPLE OF PM PARTS

Stator Core for Electric Motors,

Made from soft magnetic composite,

and Iron

Rotor core for hybrid electric motors,

Made from Copper steel

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PM PARTS EVERY WHERE

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- PM process can be automated.

PRODUCTION OF METALLIC POWDER

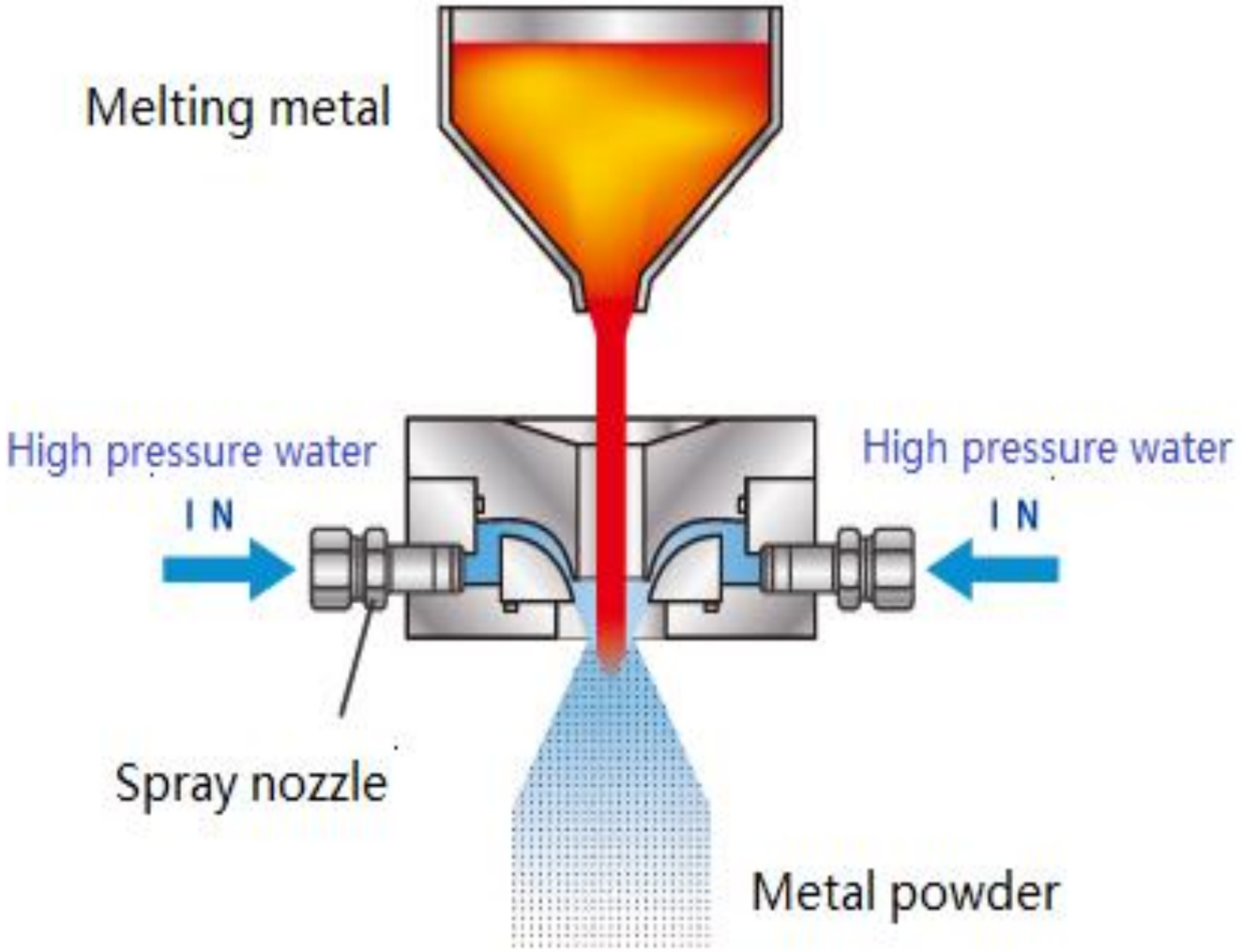

Image Source: http://www.mt-innov.com/index.php?ac=article&at=list&tid=12

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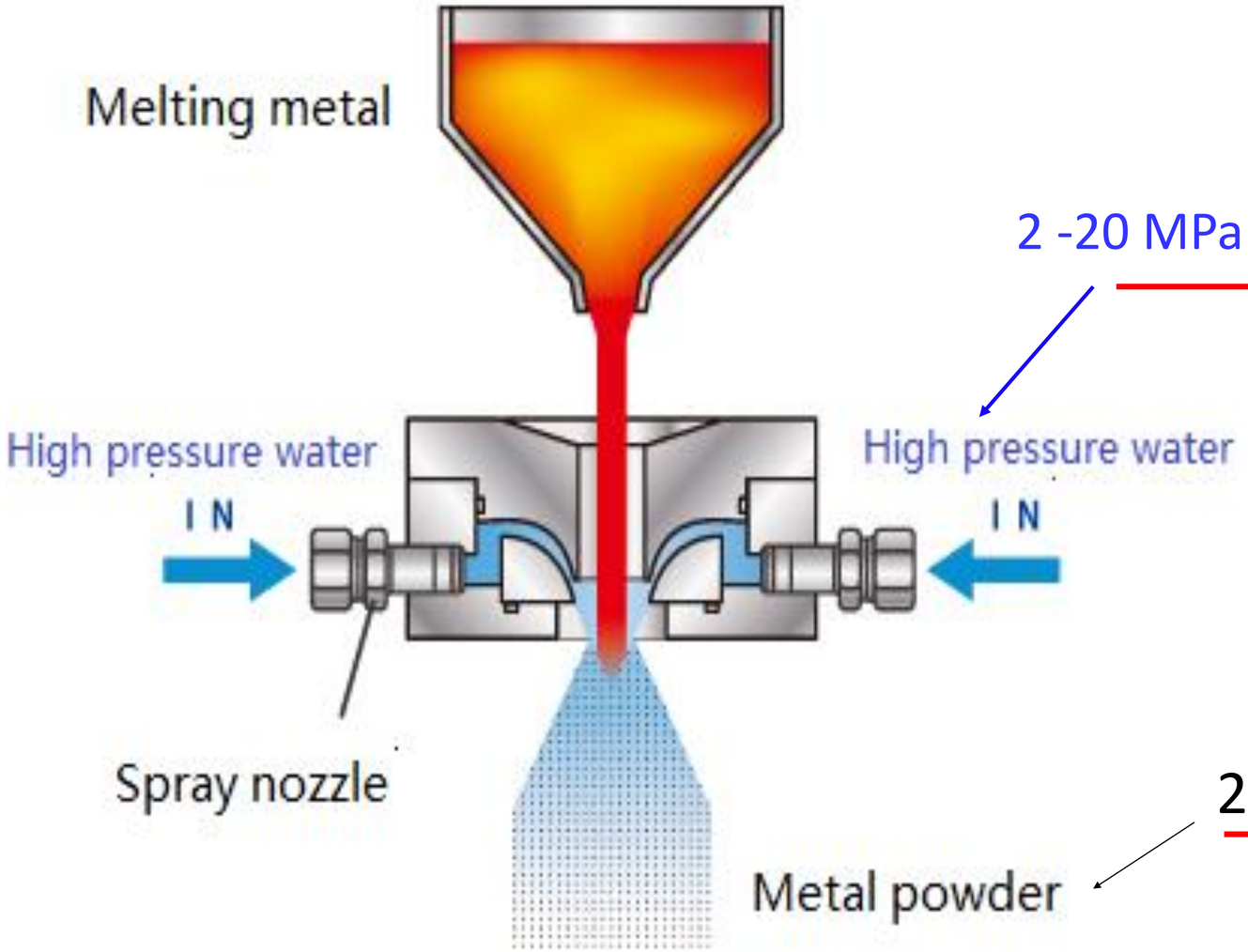

2 -20 MPa (coarser to finer powder)

200-5 μm

Image Source: http://www.mt-innov.com/index.php?ac=article&at=list&tid=12

THE SEQUENCE OF PM PROCESS

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- Add lubricant (oil)
- Pressing
- Sintering

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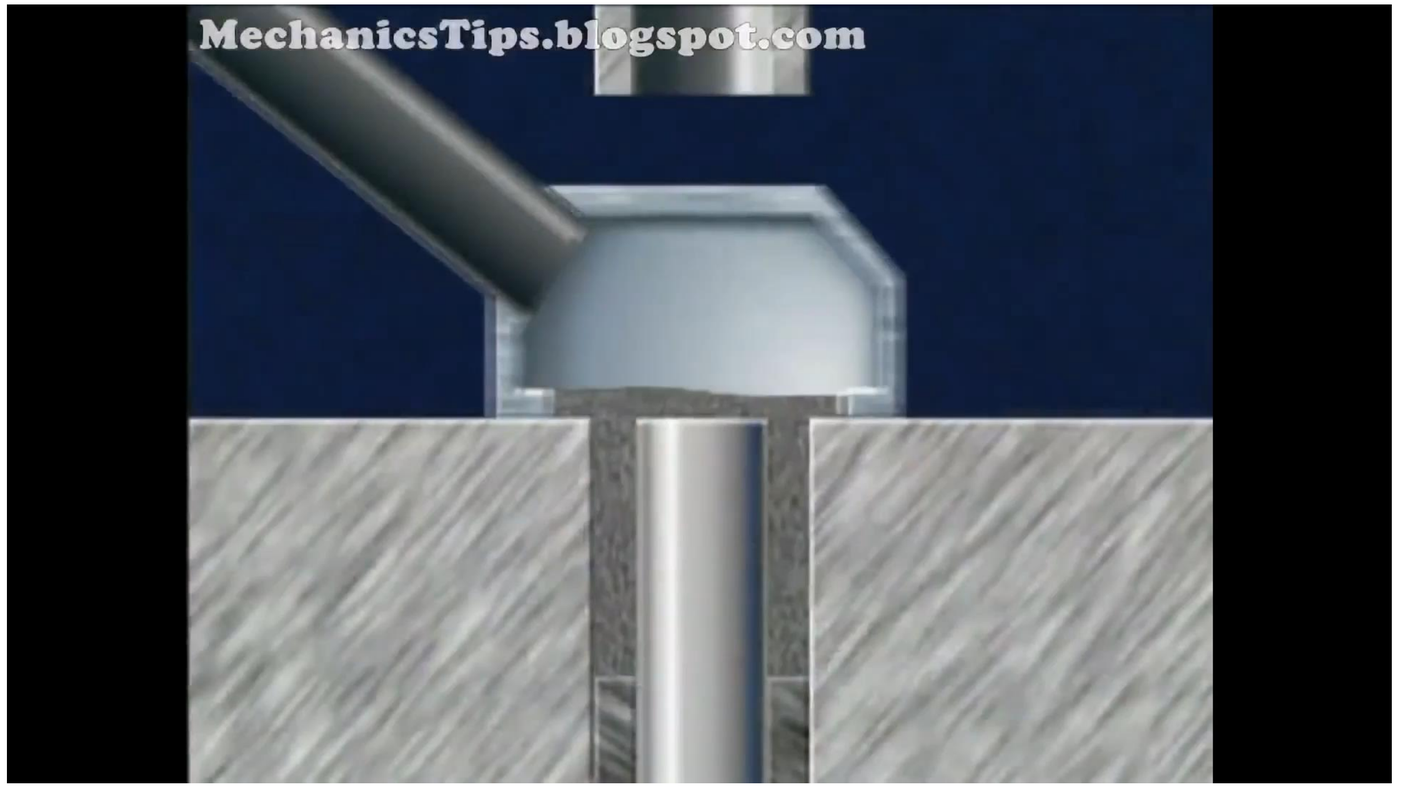

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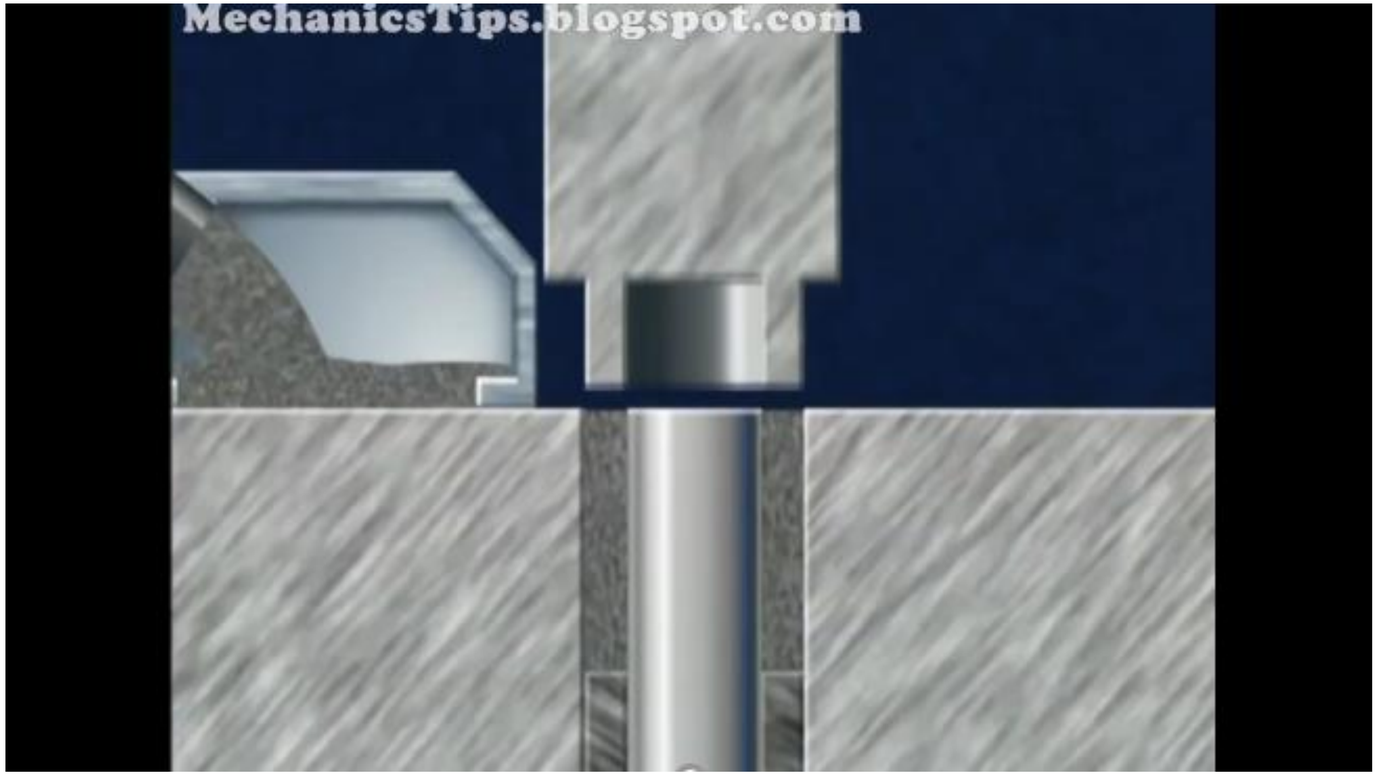

Required Pressure:

- Ferrous Powder: 400-700 MPa
- Aluminium alloy Powder: 100-400 MPa
- Copper and Bronze alloy : 400 MPa

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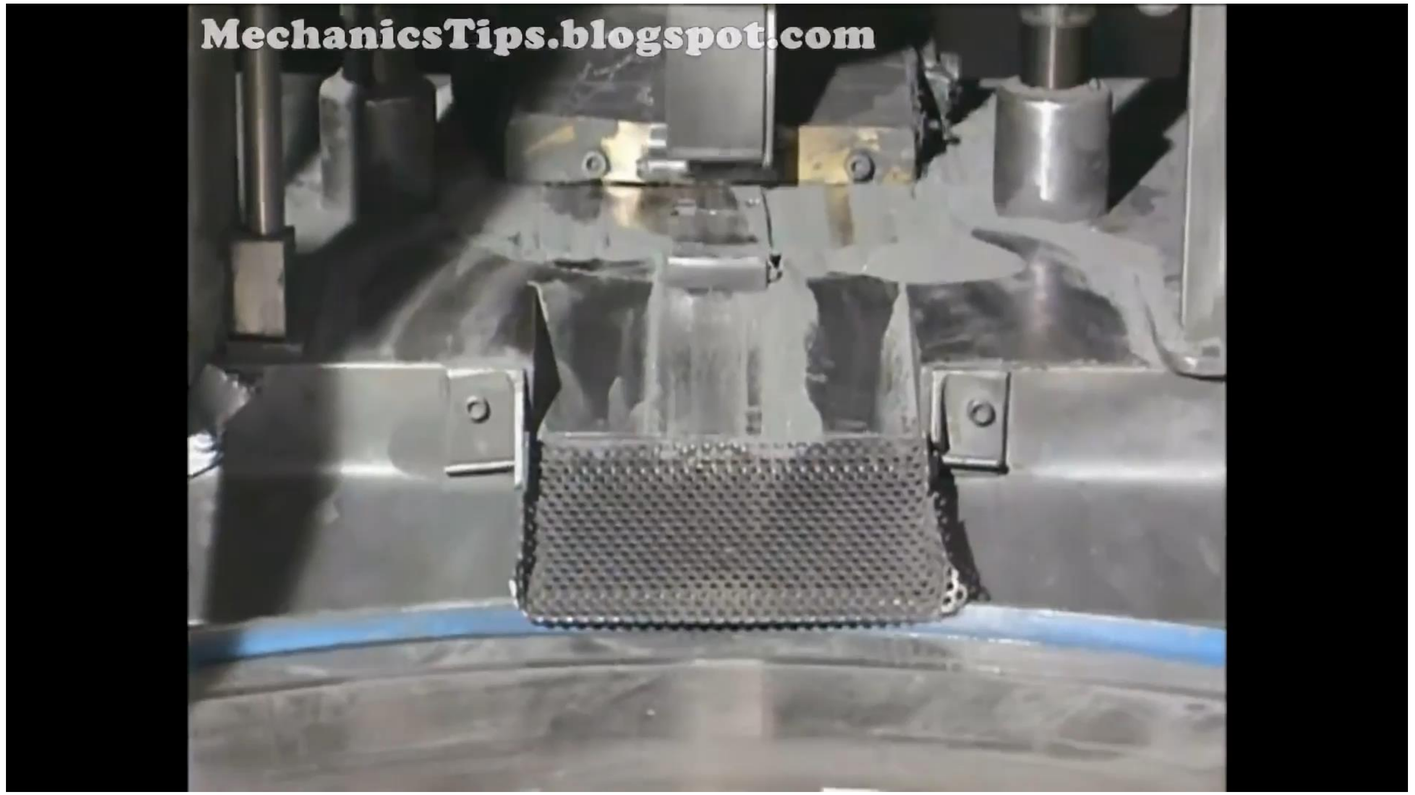

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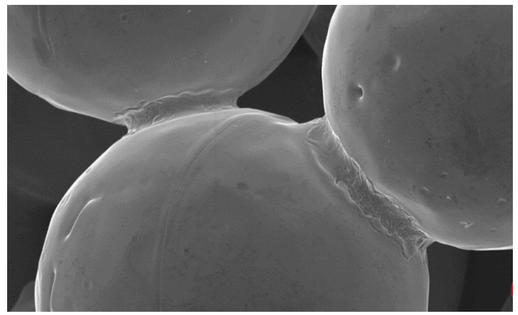

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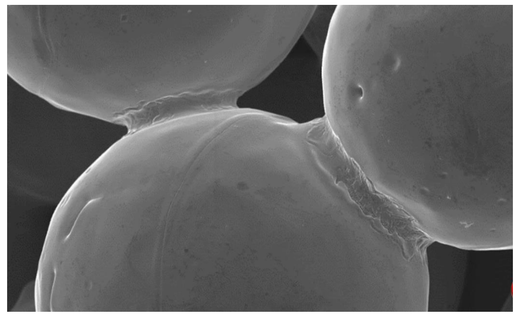

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SECONDARY OPERATIONS

1. Machining

For geometrical features that cannot be achieved by pressing, like threats, side holes

SECONDARY OPERATIONS

2. Oil Impregnation

For self-lubricated bearing or gears, usually Bronze or Iron about 10% volume oil, by immersing the sintered parts in a bath of hot oil.

SECONDARY OPERATIONS

3. Infiltration

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For pressure tight parts, Liquid Polymer seep into the pore spaces and then solidify.

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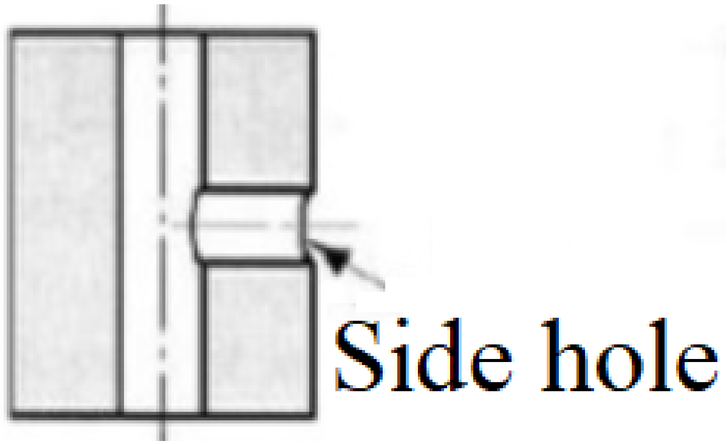
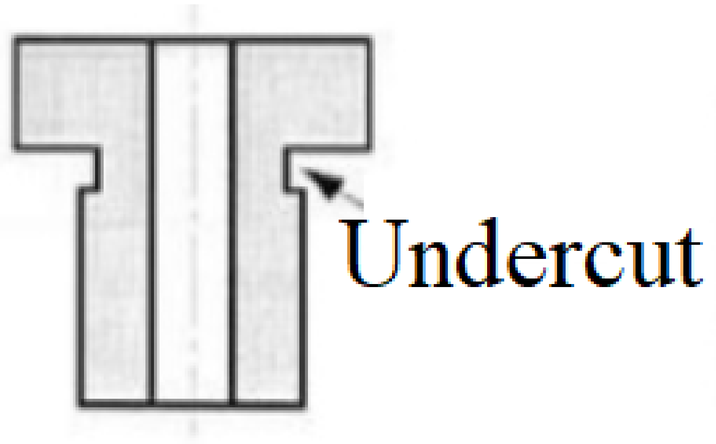
- **By Other Metal**

For improve toughness, strength or other physical properties, The pores of PM part are filled with a molten metal, the melting point of filler must be below that of the PM part

DESIGN CONSIDERATION

Part Features to avoid:





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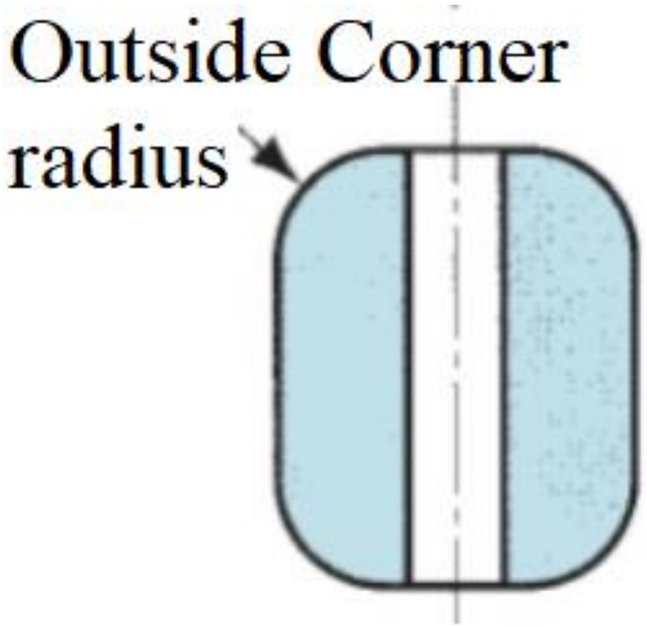

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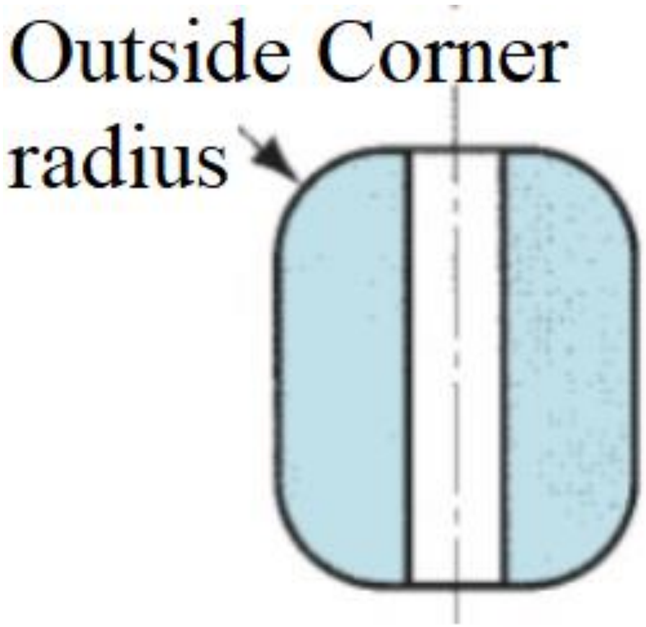
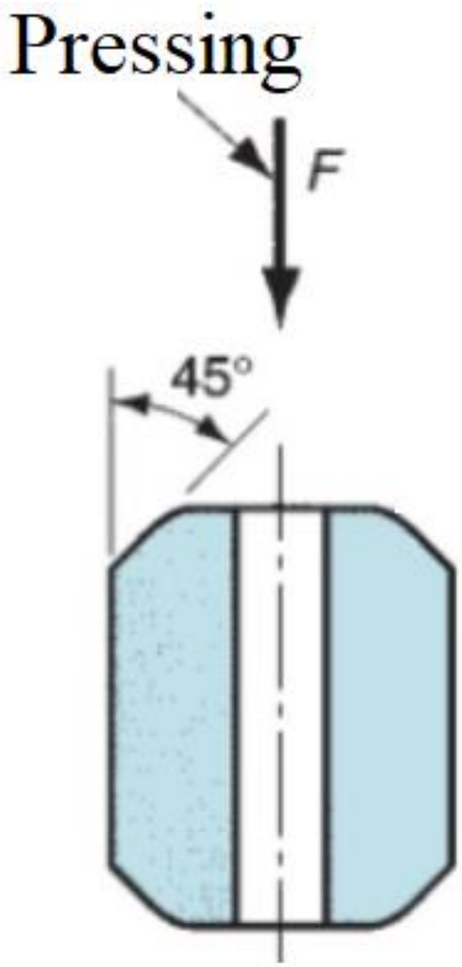


Recommended



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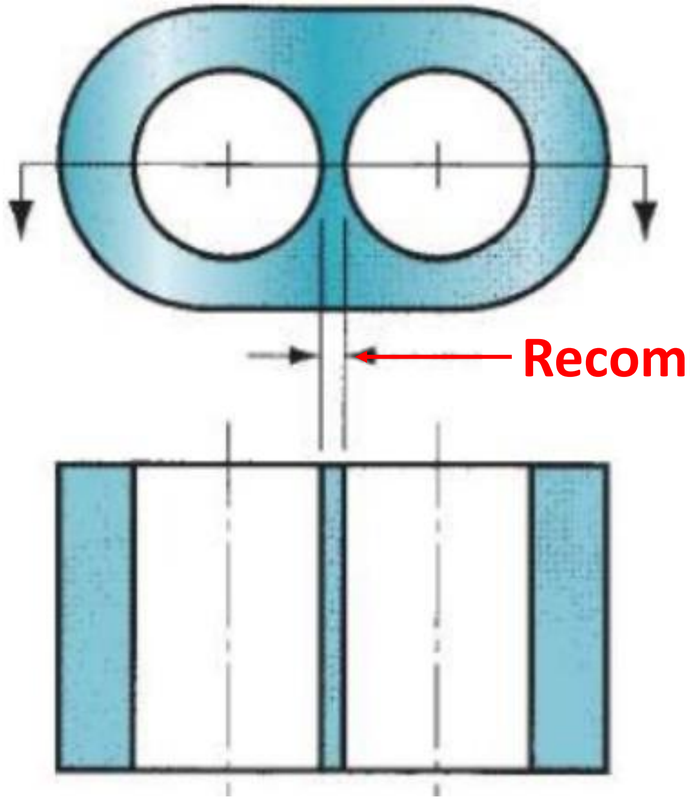

Recommended Wall thickness $> 1.5\ mm$