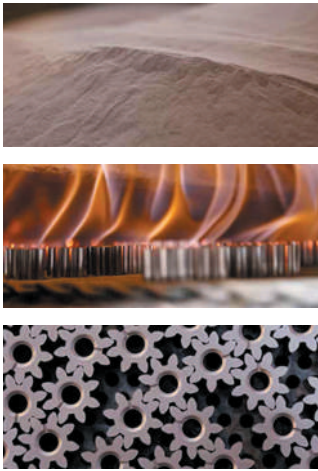


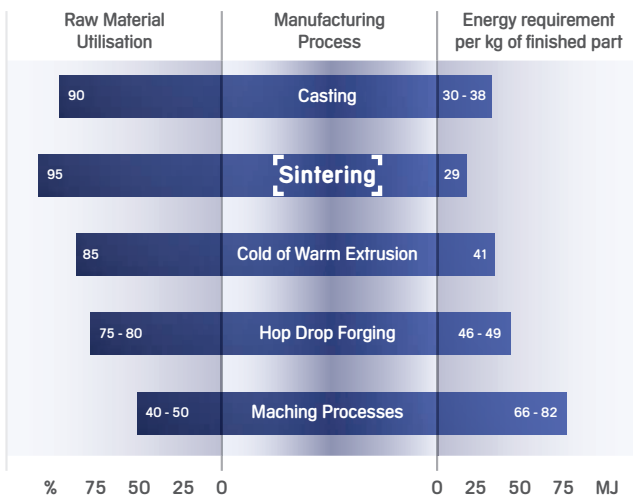
# SINTERED MECHANICAL PARTS



French leader market in sintering, Poral has a longstanding relationship with car manufacturers and industrial key players



### Main advantages of sintered part manufacturing



Raw material utilisation and energy requirements of various manufacturing processes.

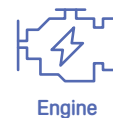
Process	Iso-Quality IT												
	5	6	7	8	9	10	11	12	13	14	15	16	
Conventional PM-technology													
Conventional PM-technology with sizing													
Investment casting													
Diecasting													
Warm working extrusion													
Cold extrusion													
Turning													
Cylindrical grinding													

All tolerances are rough values and depend on the size of the components and on the material!

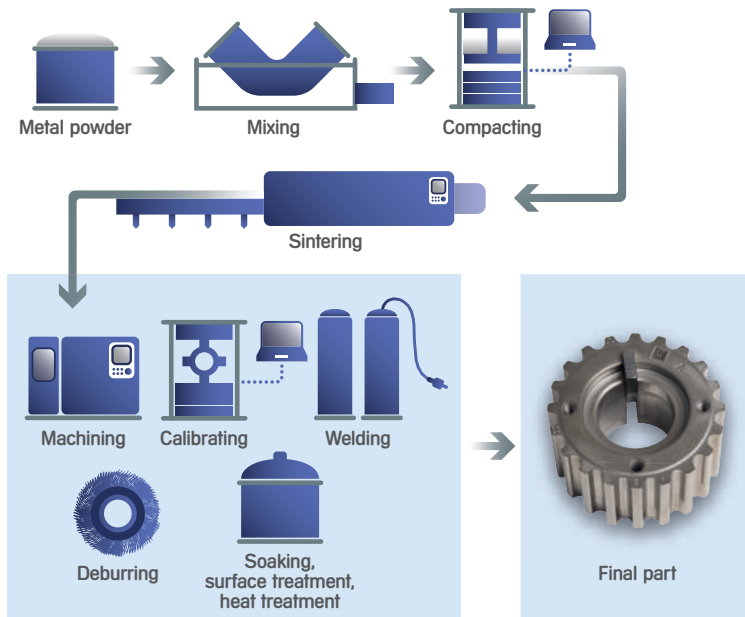
- › Complex custom part with dimensional accuracy ISO 6-8
- › Densities : 85 to 97% (locally 100%)
- › Wide portfolio of materials with better mechanical properties
- › Large series : from 1.000 to 3.000.000 parts/year
- › Green technology
- › Weight reduction



### Main application of sintered structural components

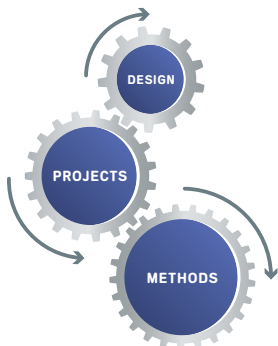


# A valuable process expertise

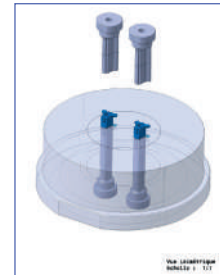


- › Hydraulic and mechanical presses from 15 to 650 tons force.
- › New furnace for high temperature sintering and rapid cooling, controlled atmosphere.

# A technical team involved to meet customer requirements



- › Products development
- › Tooling design
- › Projects monitoring
- › Process control
- › Continuous improvement



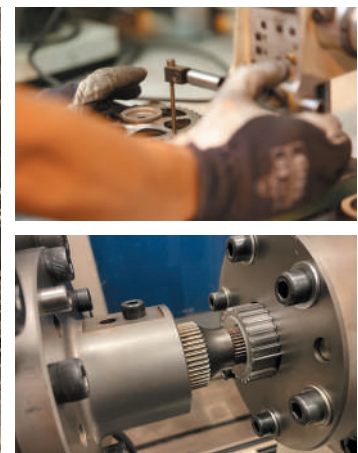
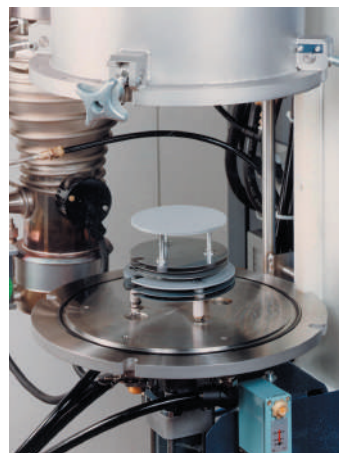
*In-house tooling manufacturing*

## From development to final parts quality control.

## Know-how in metallurgy, component design and properties characterization.

Lab furnace for R&D projects – high temperature, partial pressure, accelerated cooling, etc.

Equipment for torsion test, component cleanliness measurement, dimensionnal analysis metallography, etc.



# For each application, an appropriated material

Materials	Alloying elements	Key features	Applications
PM traditional steels	C, Cu, P	High ductility because of liquid phase sintering allowing quality sizing operation.	High dimensional accuracy
Low alloy steels	C, Mo, Ni, Cr	Sinterhardening grades - High strength and high hardness with no need of secondary quenching operation.	High mechanical performances
Treated steels	C, Mo, Ni, Cr	High surface hardness and high core toughness after case-hardening.	High wear resistance and high fatigue resistance for high demanding applications, such as gears.
Soft magnetic	P, Si, composites (SMC)	High magnetic permeability and low coercivity. SMC grains are insulated for low Eddy current loss.	Electromagnet because soft magnetic materials are easily magnetised and demagnetised. SMC are used for AC applications - their properties are similar to laminated core with higher design potential.
Stainless steels	Cr, Ni, Mo, etc.	High corrosion resistance, high creep resistance.	Oxydizing environment, high service temperature, food.
Nickel-based alloys (Inconel, Hastelloy, Monel)	Cr, Fe, Mo, Cu	Highest corrosion resistance and highest creep resistance.	For high demanding applications with severe corrosion environments or high service temperature.
Copper-based alloys (Bronze, Brass)	Sn, Zn	Low friction resistance, high thermal and electrical coefficient, good corrosion resistance.	Moderate corrosion resistance, sliding contact, electrical applications.



## Behind a material, a powder mix:

The chemical composition is obtained by mixing different powders. The mix is made from elementary powders (Iron, Graphite, Copper, etc.) and pre-alloyed powders. The range of metallic materials used for mechanical parts is extremely varied. The composition and properties of the most commonly used grades are standardized (Standards ISO 5755 or MPIF-Std35).

## Porosity, and input data:

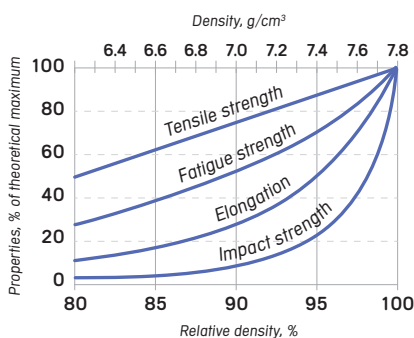
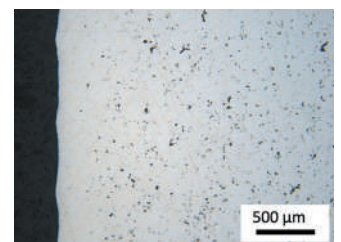


Diagram showing the influence of density on mechanical properties.

The porosity rate, or relative density, of the material is adapted according to the design of the part and the desired properties.

Depending on the mix and the geometry of the part, densities above 93% can be achieved by the standard process – higher local or overall densities can be achieved with additional processes.



Micrograph showing the densified surface of a part after a shot-peening treatment (in bright the metal part, in dark the porosity).

# Sintered Mechanical Parts

## Toothed parts

### Main characteristics:

- › Inner, outer and front tooth
- › Ovoid design possible
- › Material and Heat treatment to improve tooth wear and fatigue strength
- › Multiple tooth sections with various profile
- › Sprocket with integrated or fitted key for torque transmission

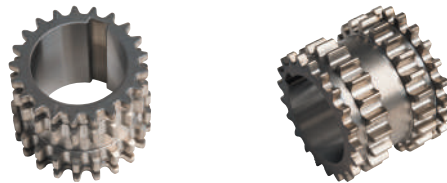
### Belt drive



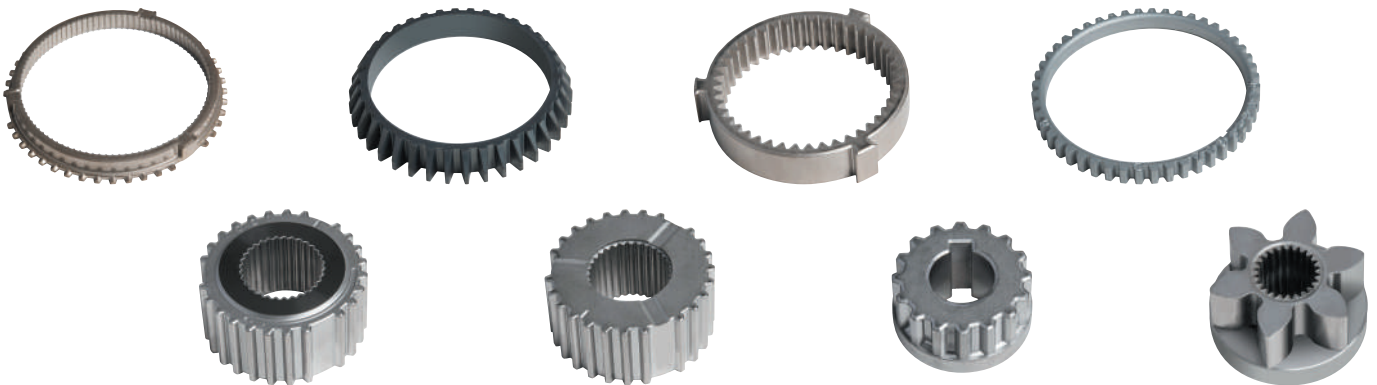
### Pinion gear or fluid transfer gear



### Chain drive



### Other toothed parts



## Shifter fork

- › High tensile strength



## Spacer

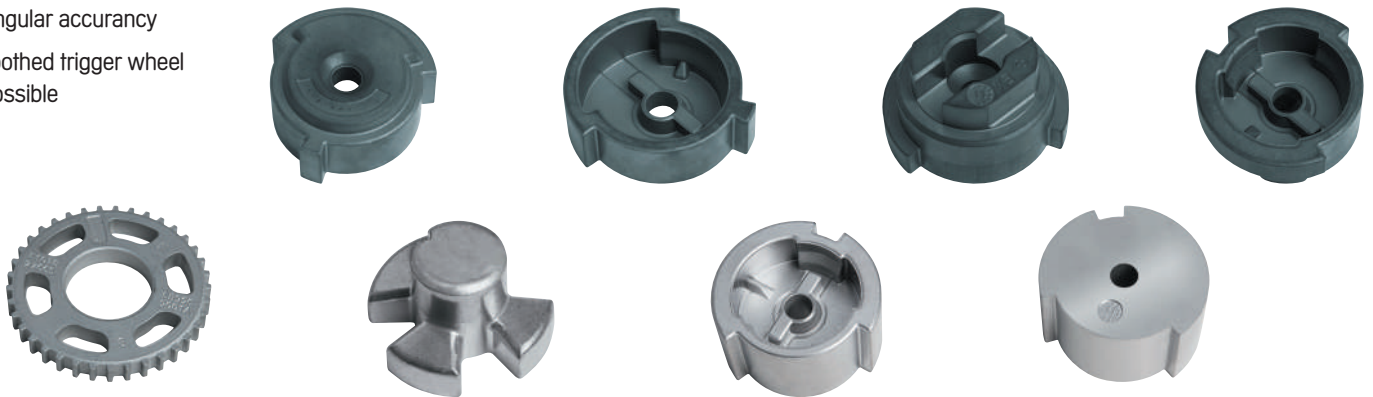
- › Both faces machining with dimension accuracy ISO 7



# Sintered Mechanical Parts

## Trigger wheel

- › Angular accuracy
- › Toothed trigger wheel possible



## Hub flanges

- › Inner diameter defined for shaft fitting
- › Threaded holes on the flange



## Cam

- › On demand cam profile manufacturing



## Fluid circulator

- › Sealing by steam treatment



## Magnetic parts

- › Various forms for magnetic properties



# Sintered Mechanical Parts

## Other complex parts





SINTERED METAL PRODUCTS



MECHANICAL PARTS



POROUS FILTERS



SELF-LUBRICATING BEARINGS



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