

Casting

Introduction

History

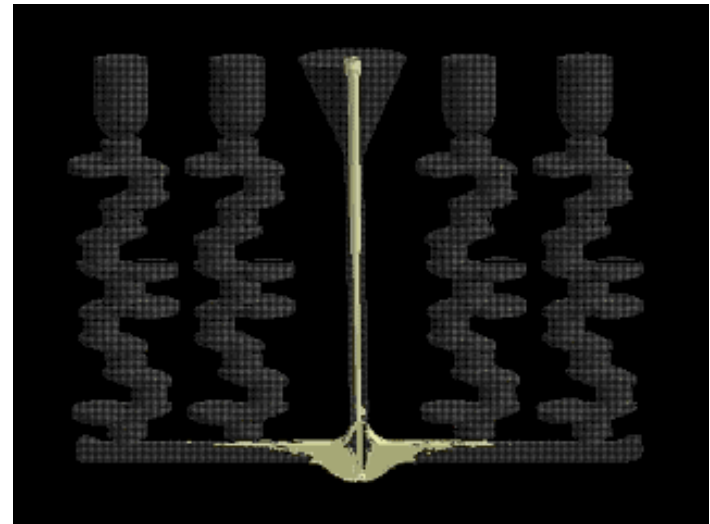
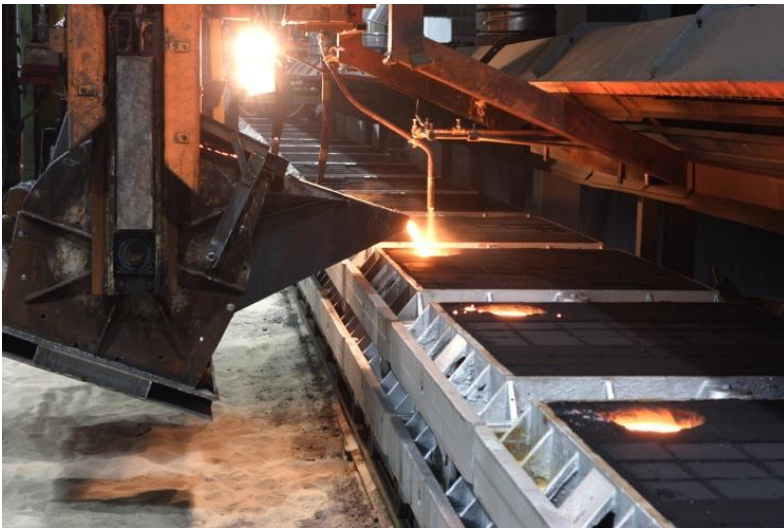
- 5000 BC Casted gold (middle east)
 - 4000 BC Casted copper (Shaan'xi, China)
 - 3000 BC Casted bronze in India and Mesopotamia
 - 2700 BC Copper Age in Europe
 - **1800 BC Bronze Age in Europe**
 - **500 BC Cast iron (China)**
 - 475 BC Tempering (China)
 - **1390 Cast iron (Europe)**
 - 1630 First temper patent in England
 - 1845 Cast steel (J.Mayer, J.C. Fischer)
 - 1894 First aluminum alloy
 - 1909 First magnesium alloy
 - **1942 Spheroidal graphite iron**
 - 1950 Casted titanium
-

The ancient way, BC castings from China



Nowadays

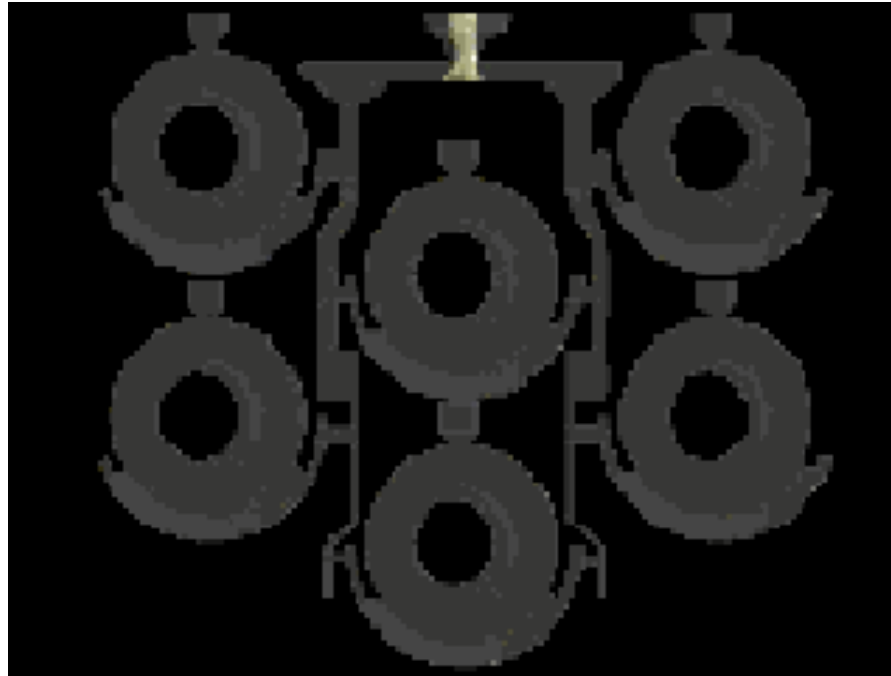
- Metallurgy and automation
- 3D CAD modelling and simulation



Casting

- Fluid metal poured into a mold and solidified by cooling

Casting six cover plates (Gravity casting)



Valmet
FORWARD



AGCO



PLANMECA



metso
automation



KONE

Menestyviä
globaaleja
suomalaisia
valunkäyttäjiä!

PONSSE



Rolls-Royce



ABB



WÄRTSILÄ



NOKIA

Teleste



GENELEC
ACTIVE MONITORING



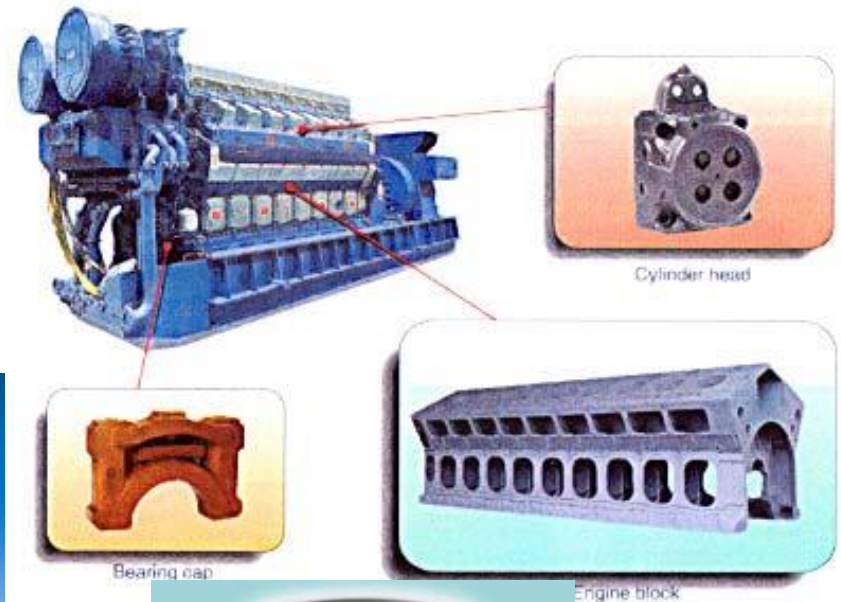
Aalto University
School of Engineering

Department of Mechanical
Engineering
4.10.2021
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Examples of challenging cast components

Motor blocks and cylinder heads

- Design, castability, material properties
- GJL tai GJS cast iron or nodular iron
- Valmet Jyväskylä Oy, Componenta Oy



Examples of challenging cast components

Wind turbine castings

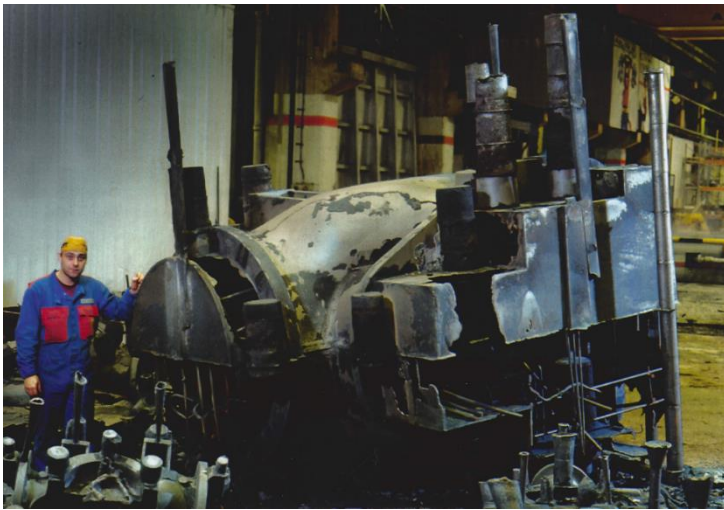
- Design, dynamics and material properties
- GJS400 nodular iron
- Valmet Jyväskylä Oy, Suomivalimo Oy, Uudenkaupungin Rautavalimo Oy, LeinoCast Oy



Examples of challenging cast components

Steel castings

- TEVO Lokomo Oy, Karhula Foundry Oy, LeinoCast Oy, Peiron Oy, Sacotec Components Oy



Pump casting after the mould shake-out



The biggest pump casting to the paper machine. Duplex steel. Karhula Foundry.

Examples of challenging cast components

Aluminium and magnesium castings

- Alteams Oyj, Alsiva Oy, Novacast Oy



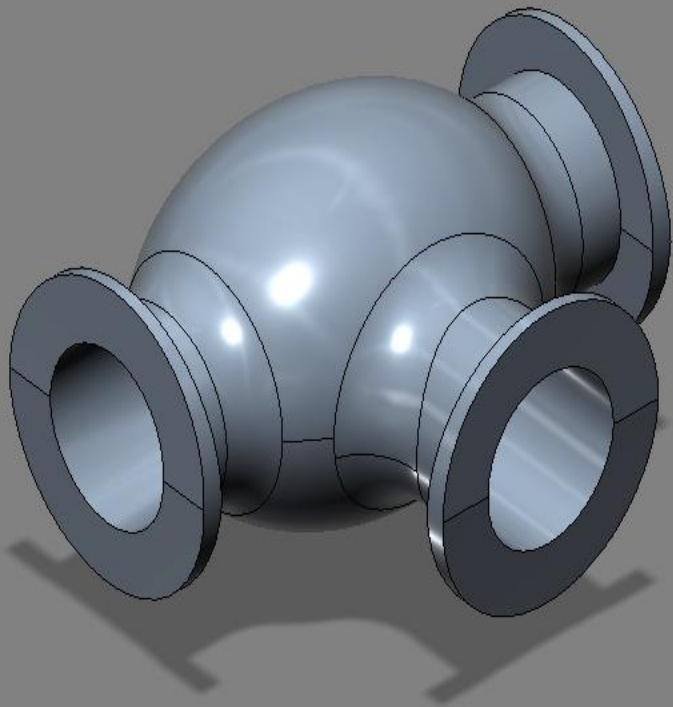
Gearbox, 90 kg, aluminium alloy.



Gearbox to the aircraft, magnesium alloy.



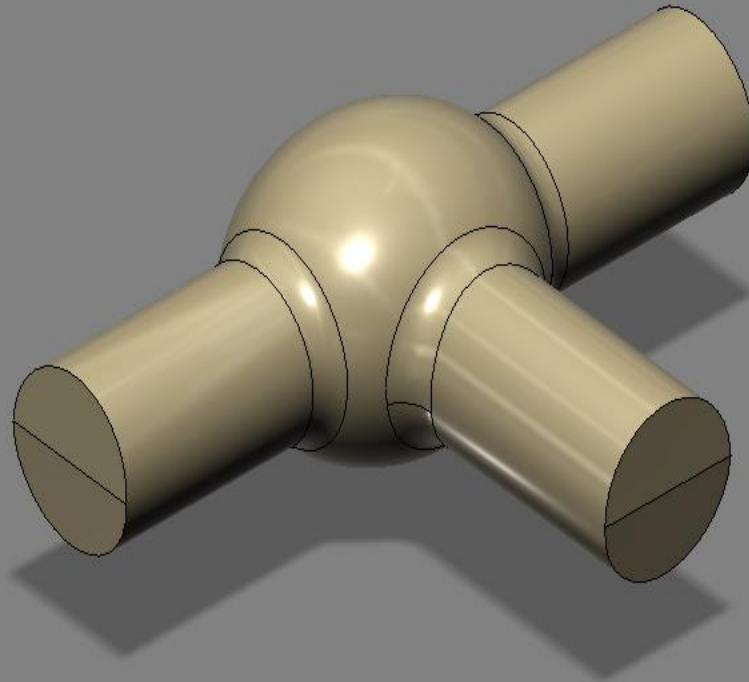
3D-model of cast component



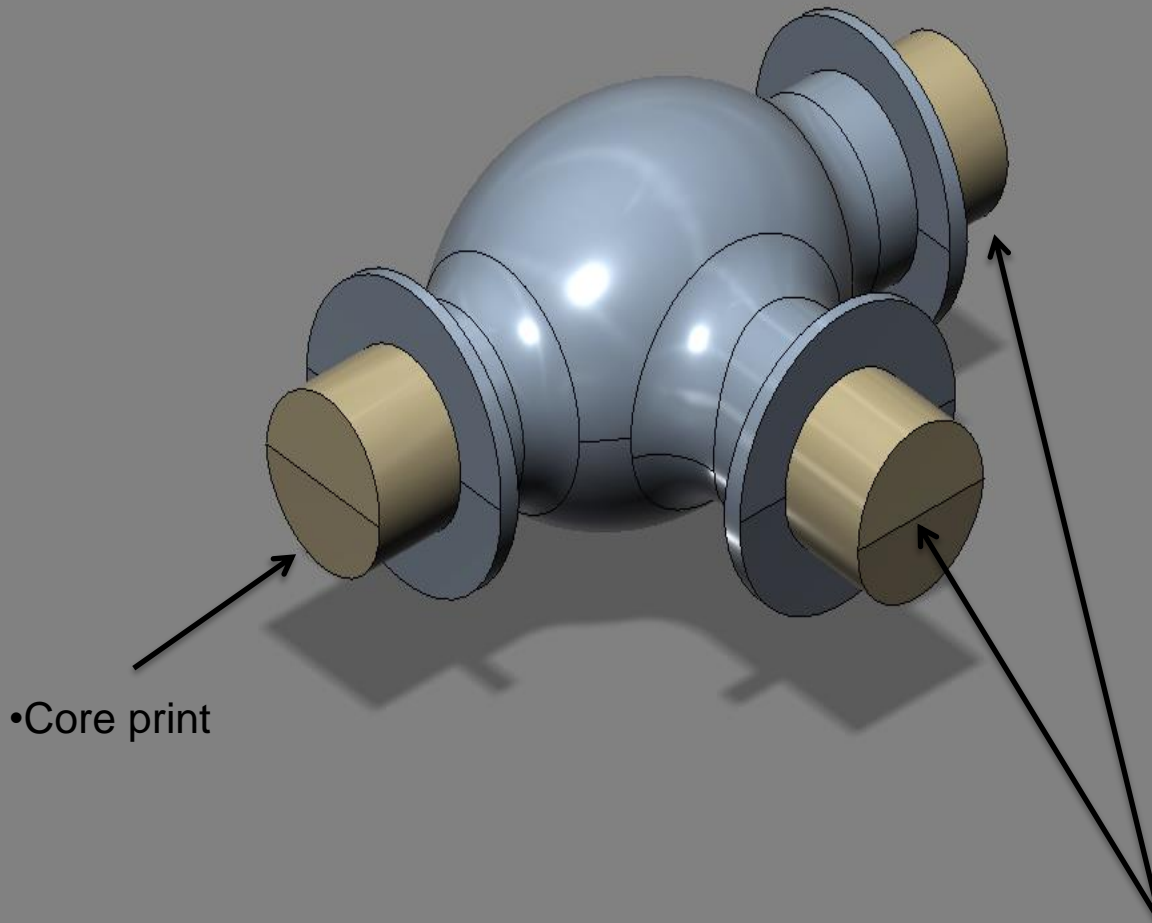


Browser

3D-model of the core



With the core you shape the hollow features of the component



•Core print

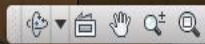
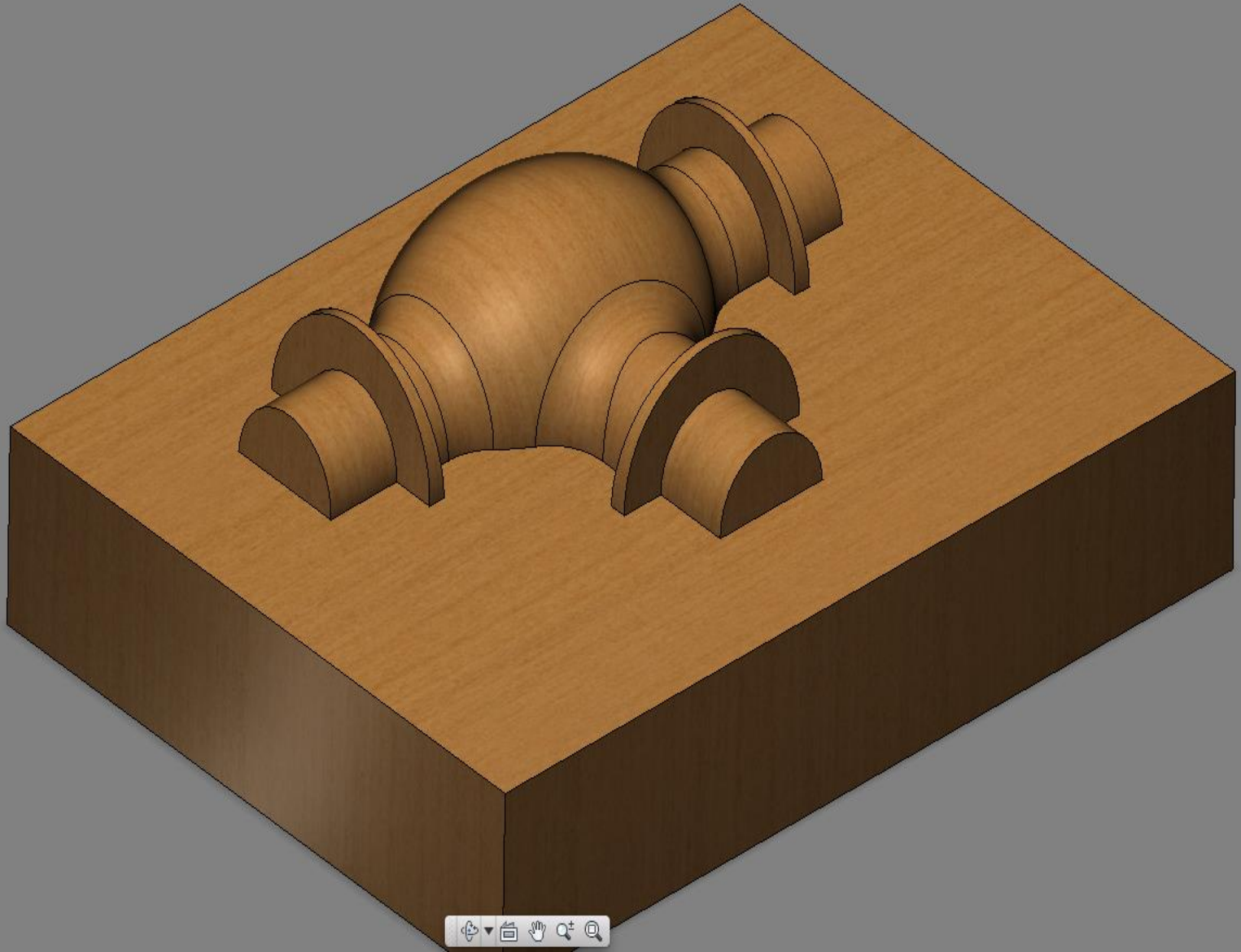
•With the aid of the core prints the core is mounted between the mould halves!



Browser

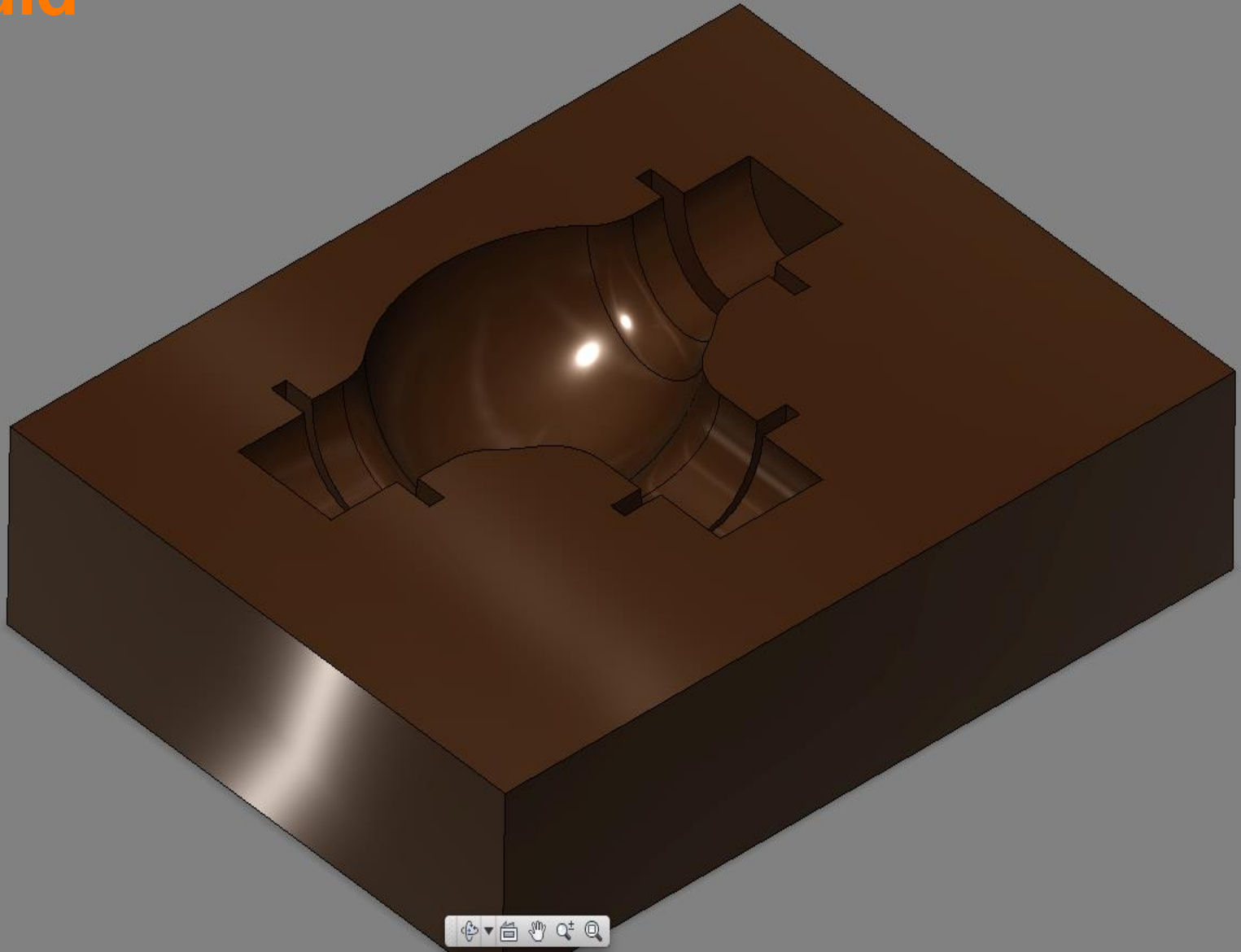
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Pattern table = pattern tool

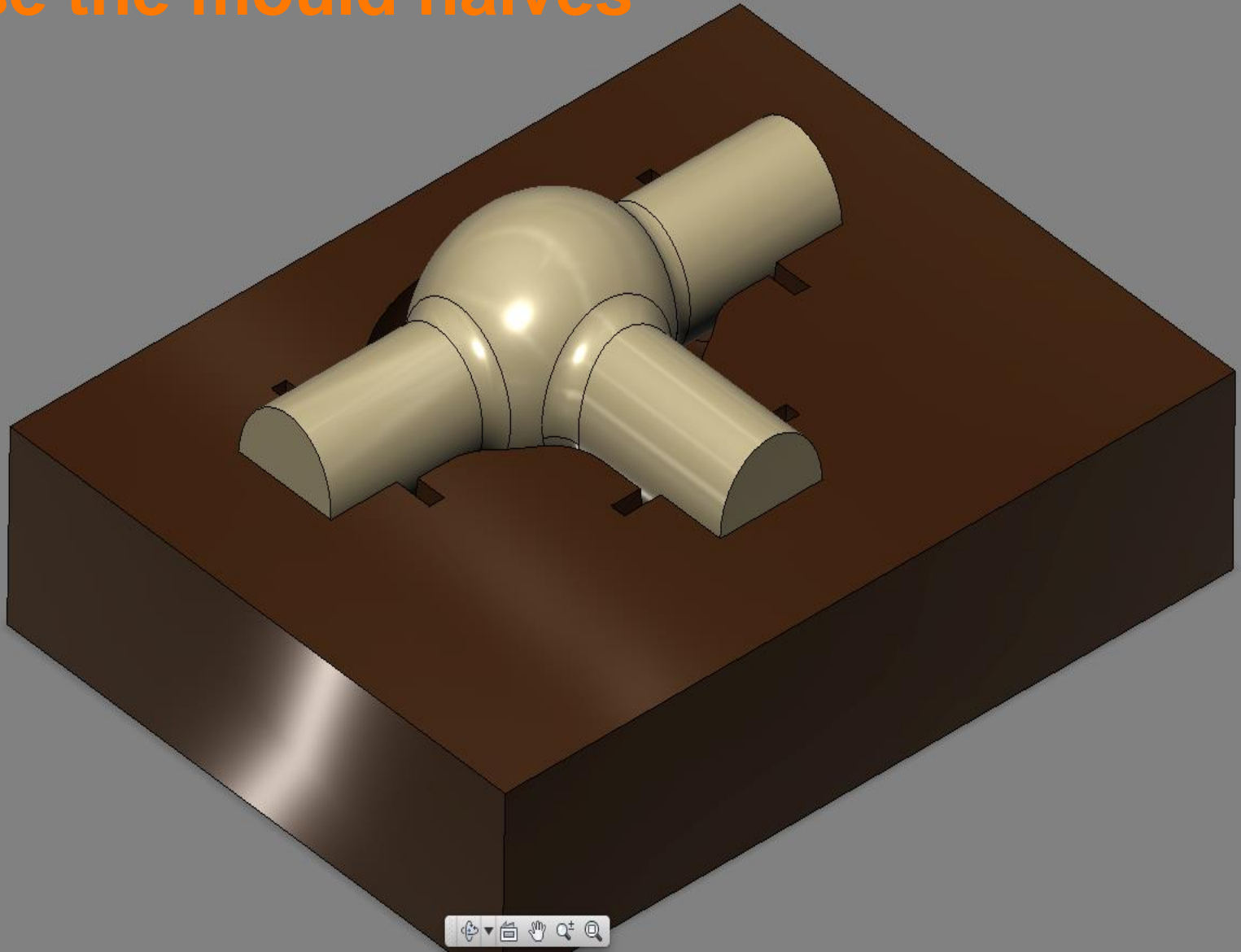




With the aid of the pattern you shape the mould

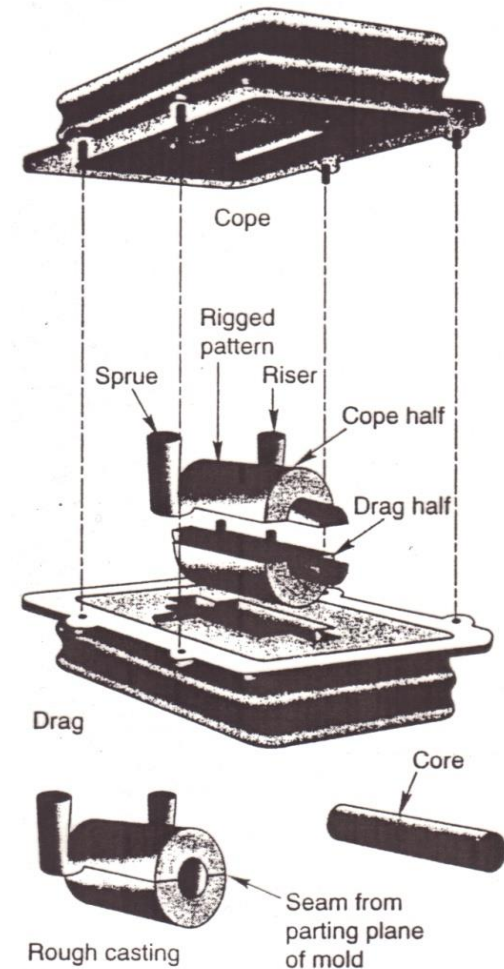


In the end you put in the core and you close the mould halves



Sand casting

- Most common casting method
- Pattern
 - Form cavity in the mould sand
- Cores
 - Hollows inside the casted part
- Gating system
 - For uniformly flow of the metal
 - Risers prevent cavities due to shrinkage
 - Gas while casting can leak



Principles of sand molding.













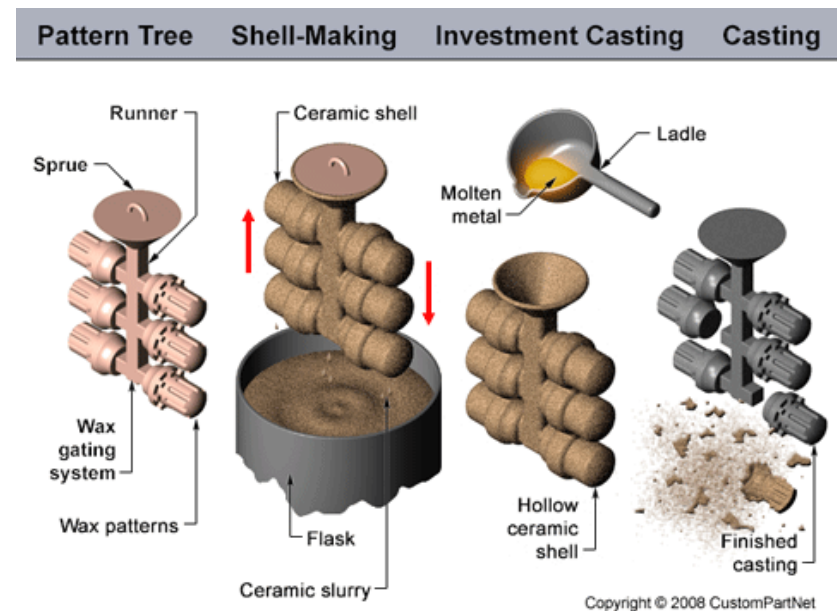






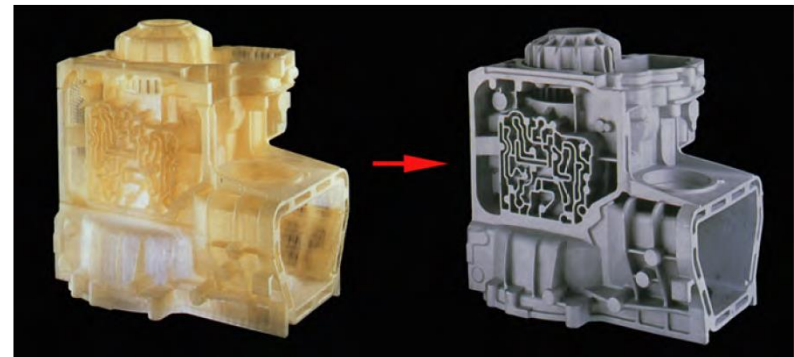
Investment casting

- Pattern Tree
 - Wax patterns
 - Connected at a gating system
- Shell
 - Ceramic slurry
 - Sand and fireclay
 - Drying
- Melting out of the wax
- Casting
- Break of the ceramic shell



Investment casting

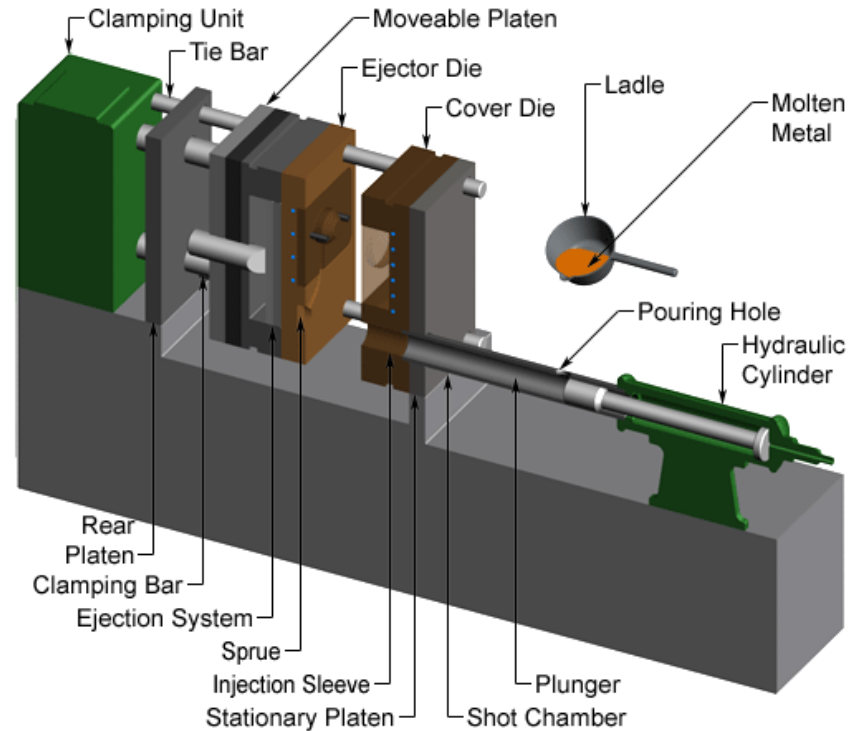
- Complex shapes
- Details
- Accurate casting
 - Little machining needed
- Very good surface
- CAD-Models direct usable
 - Rapid prototyping



Die casting (cold chamber)

Permanent mould, no pattern

- **Alloys with higher melting point**
 - Al-, Cu-, Mg-alloys
- **Metal ladled into shot chamber**
- **Injection by a plunger**
- **140 – 1400 bar/atm**
- **Fine grain due to the pressure**
 - High strength
- **200-400 shots per hour**



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