WBCVM-net

Training activities at IPU

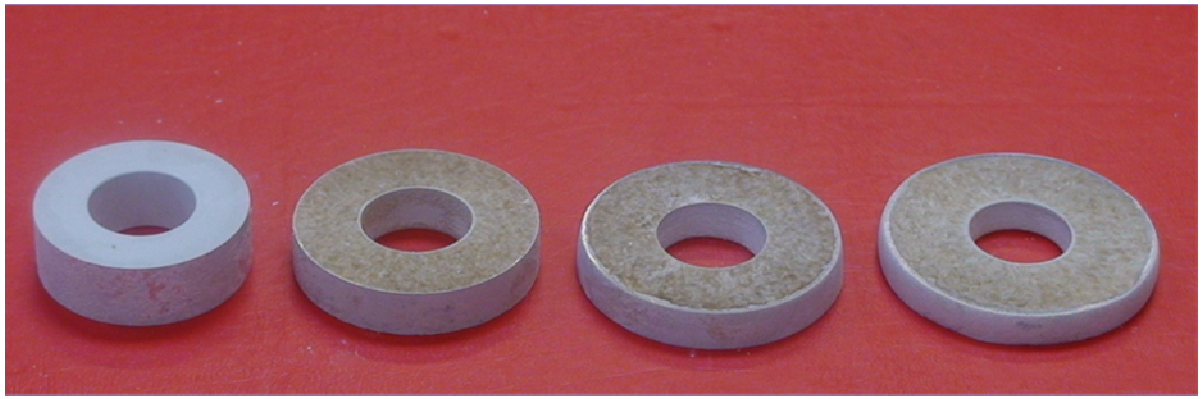
Ver 1.0

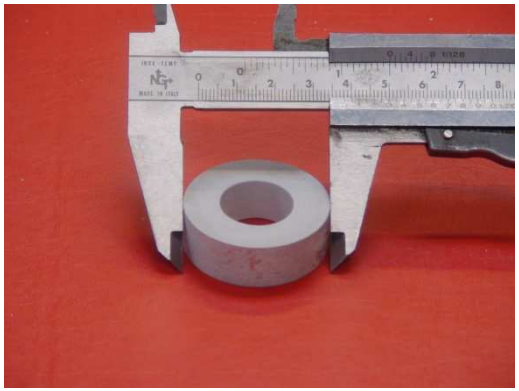
Inspiration for training topics at IPU

- Tribology(sheet metal forming)
- Tribology (Bulk metal forming)
- Measurement of heat transfer coefficient
- Material testing
- Numerical modelling
- Metrology (dimensional)
- Metrology (surface characterisation)
- Laser technology
- Micro technology
- Life long learning
- …

Tribology in bulk metal forming

The training will include lectures on friction models followed by practical excercises measuring friction in bulk metal forming processes





Exercises in measuring friction in bulk forming processes

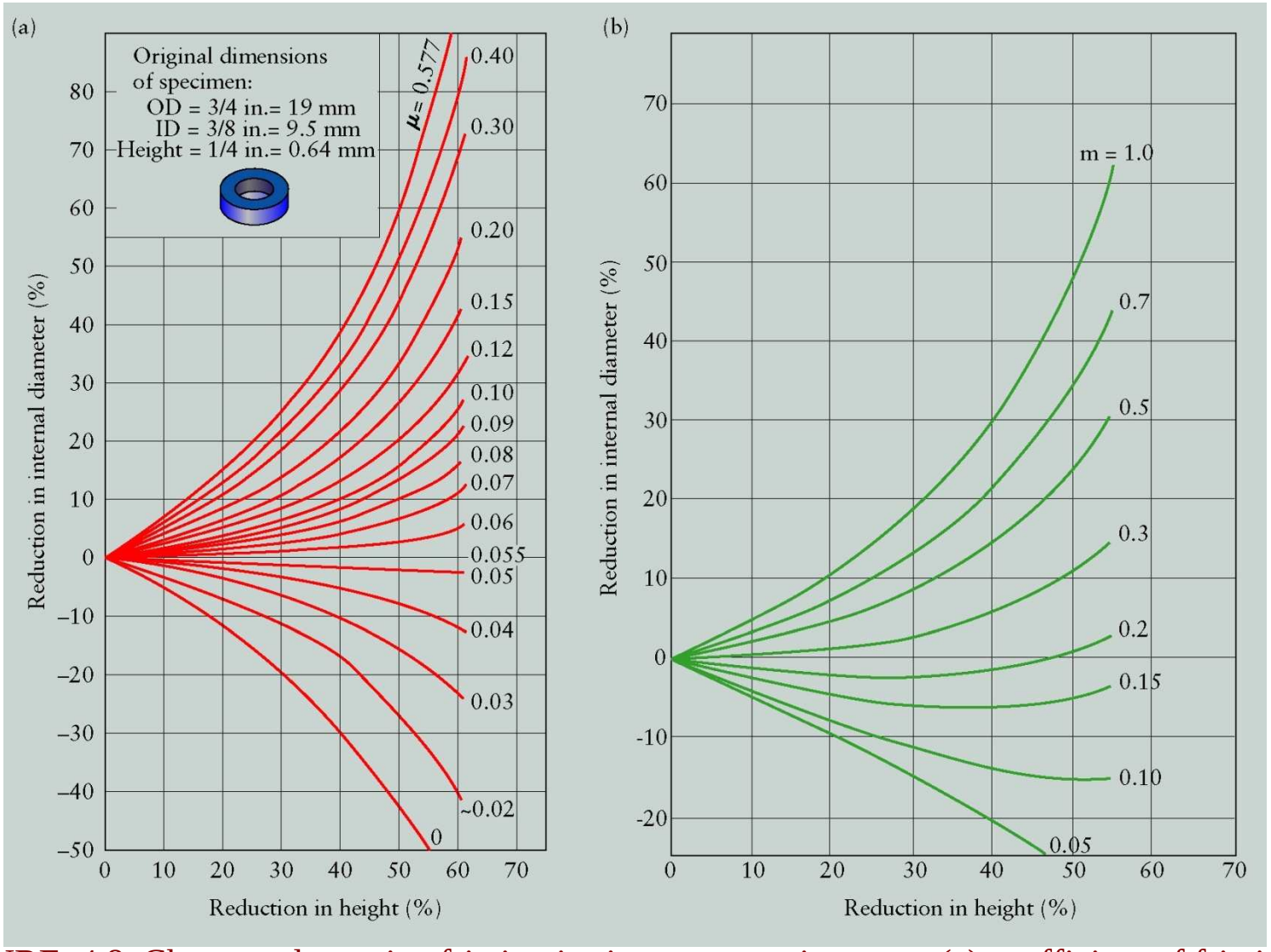
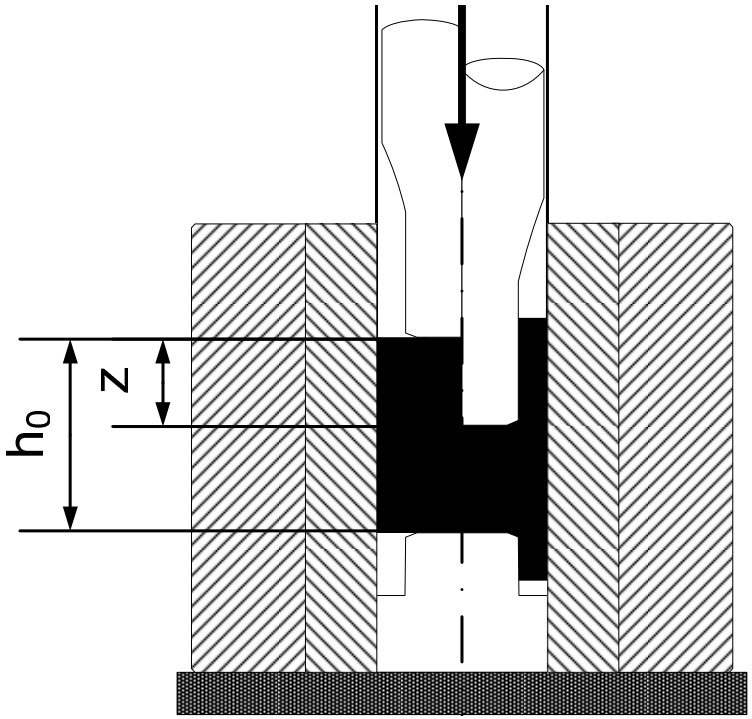


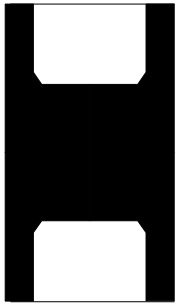
FIGURE 4.8 Charts to determine friction in ring compression tests: (a) coefficient of friction, μ; (b) friction factor *m*. Friction is determined from these charts from the percent reduction in height and by measuring the percent change in the internal diameter of the specimen after compression.

Double can extrusion (friction test for bulk metal forming)



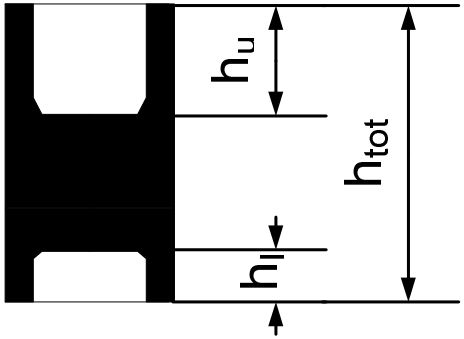
Low friction

$\frac{h_u}{h_l}=1$



High friction

$\frac{h_u}{h_l}>1$



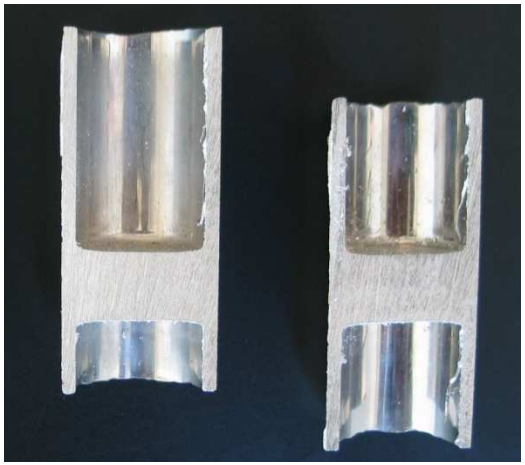
$Ø_{billet} = Ø_{container}$ = 27 mm

$r = (D_P/D_0)^2 = 69\%$

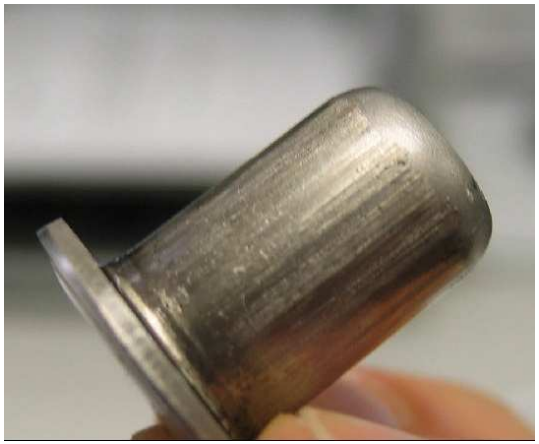
Billet geometry: $H_0/D_0 = 1$

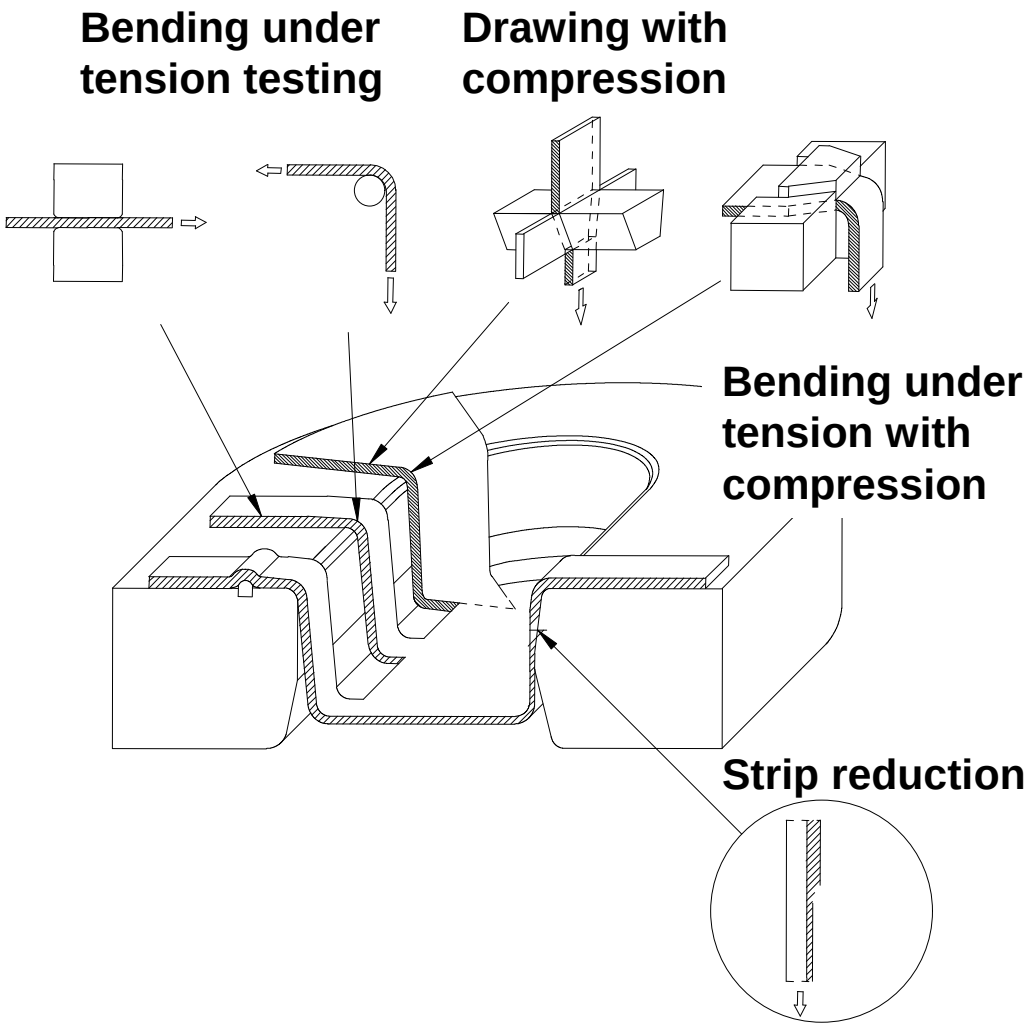
Tool material: AISI M3:2 PM, 62 HRC

Tool roughness: R_a=0.1 µm

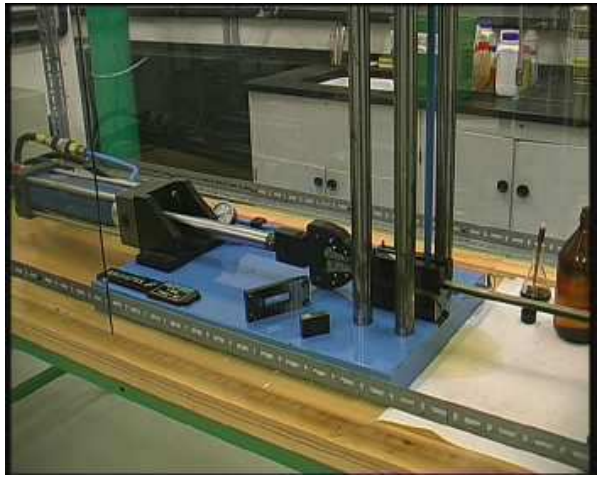


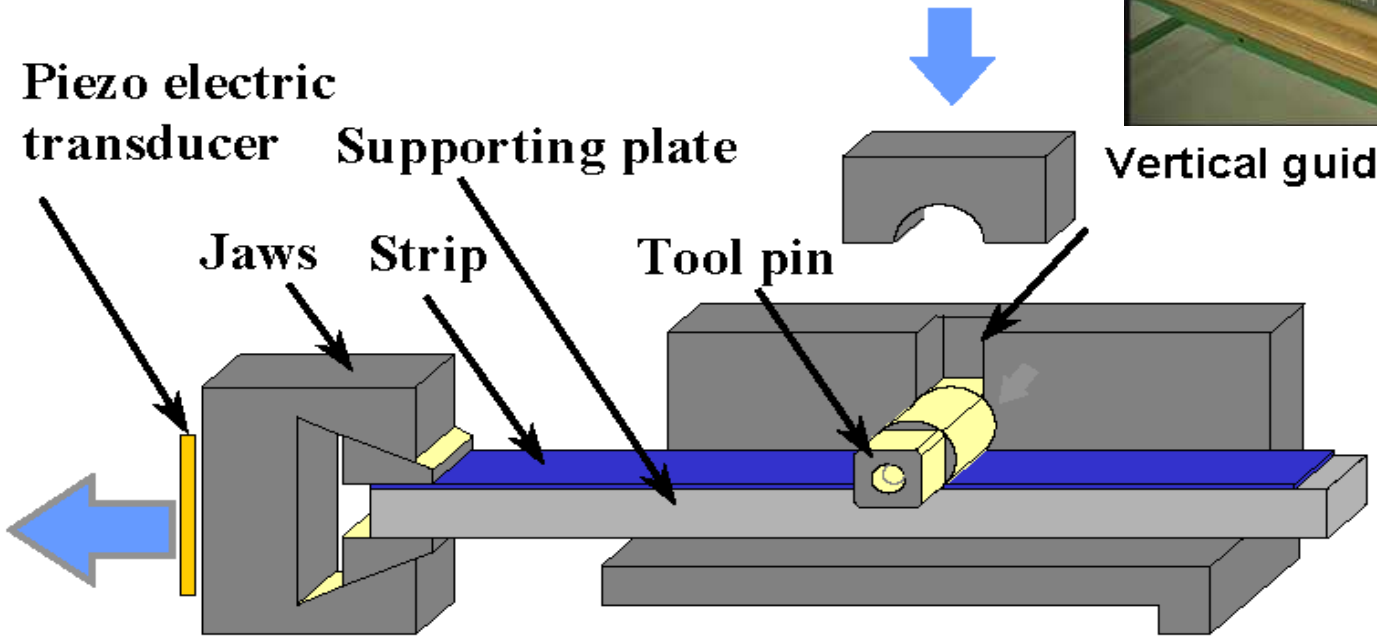
Simulative testing



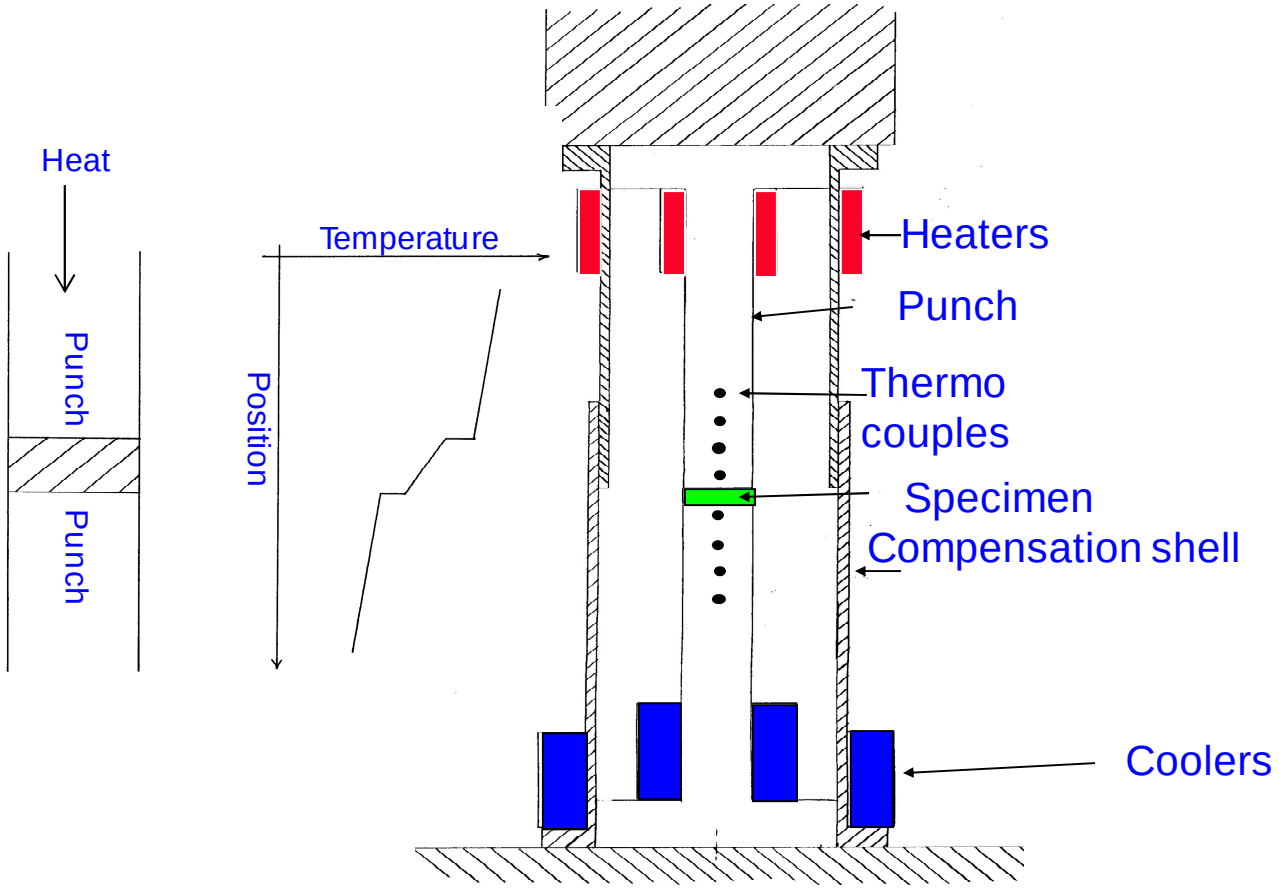


Strip reduction test

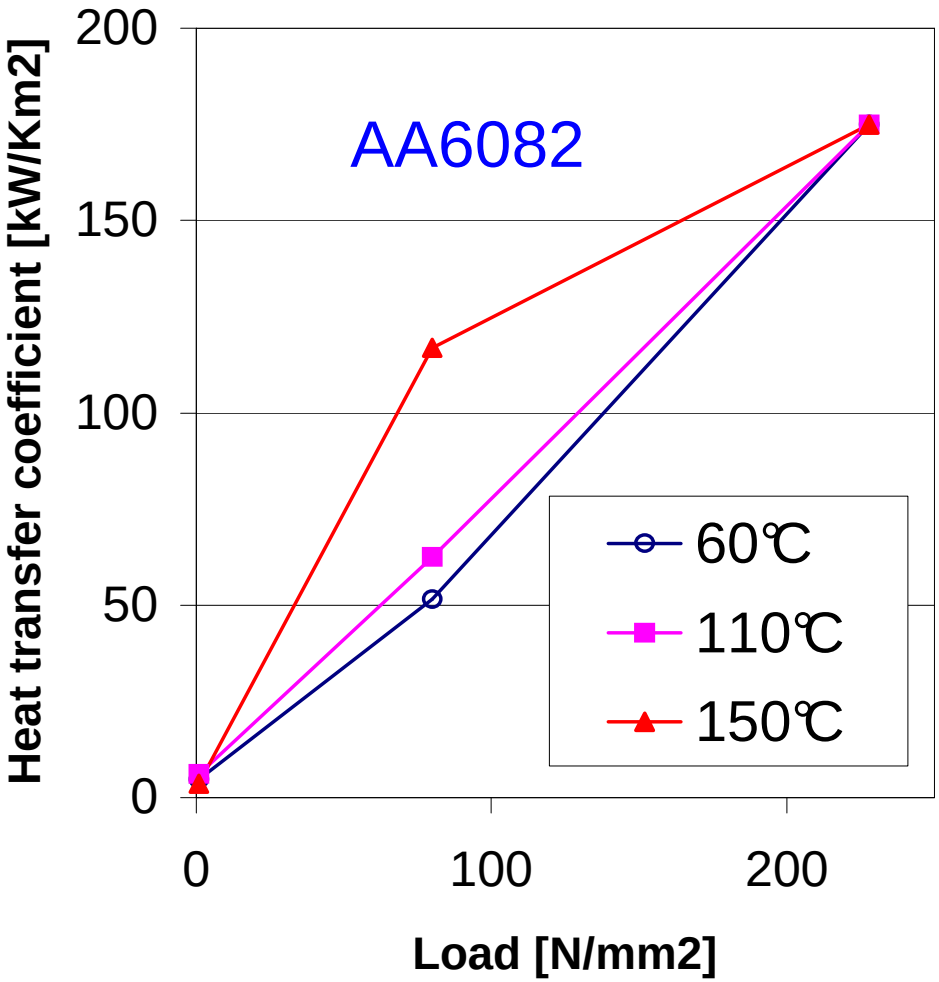




Measurement of Heat Transfer Coeefficient



HTC-measurements

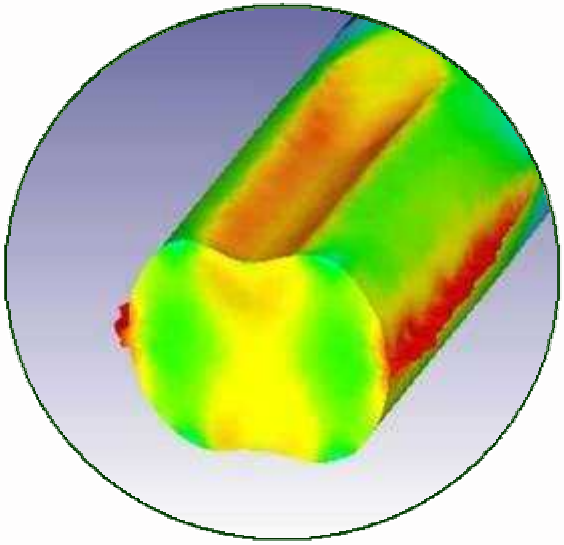


Material testing

- Compression and tension
- 1N to 2MN
- For sheet and bulk forming
- Elevated temperature

Numerical modelling

- Deform 2D/3D
- Bulk metal forming
- Elastic deflections
- Stress analysis
- Form filling



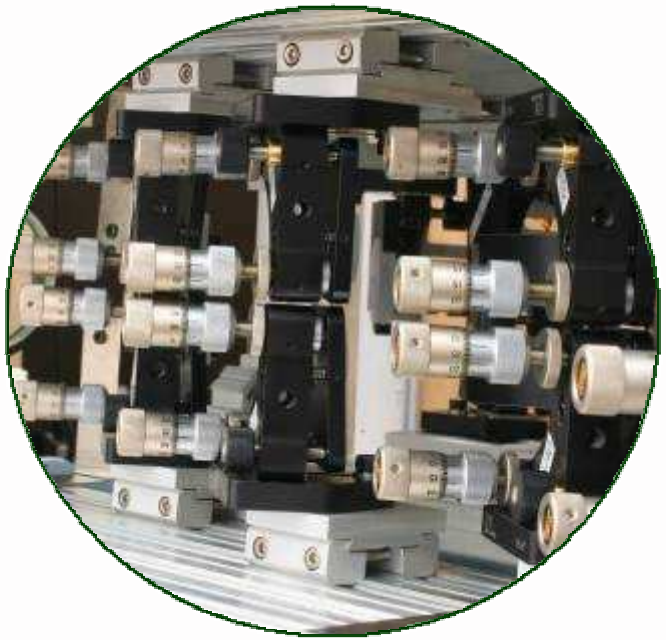
Geometrical metrology (dimensions and surface characterisation)

- Roundness
- Tolerances
- ”GPS”
- Lenght
- Roughness
- 2D or 3D

CGM

Laser technology

- Fibre lasers
- Theory
- Practical tests
- Limits
- Productivity
- …



Micro technology

- Micro tribology
- Micro forming machines
- High precision micro cold forging
- Tool design centre
  - µ-edm
  - Polishing
  - Lubrication
- Tool set with elevated temperature
- Forming of steel, Al, Ti, Cu,brass, …