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Forming Tribometer

This device was developed to determine friction factors as input data for simulation of forming processes (bulk processes like forging, extrusion, …).

This facility enables the measurement of friction between a plastically deforming ring (work piece) and a rigid plate (tool) up to 950°C. Optional geometries are available, find a more detailed description in the section below. Temperature at tool and workpiece can be controlled separately. The facility enables load forces up to 200kN and torques up to 1000Nm. It enables on-line measurement of friction force during unidirectional sliding. The radial deformation of the ring can be measured by laser (only ring/plate setup) to determine the grade of plastic deformation.

Post-Analysis may cover measurement of wear by topographic means. Investigation of surface morphology or material transfer by SEM/EDX. Changes in the subsurface microstructure can be analysed locally resolved by EBSD (Electron Back Scattering Diffraction).

Image of the Forming Tribometer: showing the Ring-On-Plate-Specimens with inductive heating system (not in position)

The device is fully PC-controlled. To the control parameters, e.g. sliding distance, motion profiles (uni, oscillating, ..), can be selected. On-line-data acquisition offers to post-process data, e.g. for automatic calculation of friction coefficients and factors in running-in- or steady state, as well as endurance of solid lubricant coatings.

Measurement of

- Friction force / coefficient / friction factor
- Linear wear (on-line)
- Wear (geometric or mass loss)
- Environmental Data
- Optional (e.g. residual gas, user defined)

Ring at end of forming test

inductive heating of ring

the whole test device

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Specifications	
Samples	Ring-on-plate, bolt-on-bush, ring-on-sheet Lubricants with Ring-on-plate possible See Annex below
Test (Output)	online measurement of • Friction force / Friction coefficient / Friction factor • Radial elongation (deformation of ring) • Linear wear (stroke) • Temperatures Ring / Plate
Loads	1000 to 200.000 N (loading profiles can be programmed)
Speed / Motion	Motion selectable from unidirectional to reciprocating (angles selectable) 0.001 <> 0.1 m/s (1 to 70rpm, higher rpm possible only for lubricated contacts)
Vacuum / Environments	Air
Temperatures	from RT up to + 950 °C can be controlled separately between ring and plate to simulate different temperature between tool and work piece
Accuracy	Torque ± 1 Nm (load cell), but reproducibility depends on the contact materials Sample temperature (pin and disc separately): ±10°C Linear Wear (Stroke): 0 <> 2mm, ± 0.02mm Radial deformation: +/- 0,1mm

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ANNEX -- The UFT offers several geometries

The UFT offers different geometries depending on the finally needed output. Below different examples for geometries of specimen are shown.

The new ring-to-plate geometry also allows to test lubricants, e.g by using simple sheets instead of plates.

Publications describing tests done on this device:

- "Development of a test method for determining friction at deformation conditions", Schuster M, Merstallinger A, Horwatitsch D., Tomala A, Proceedings ÖTG Symposium 2013, ISBN 978-3-901657-46-7.

- "Tribological Performance of solid lubricant at high temperature forming applications", A. Tomala, S. Hernandez, M. Rodriguez-Ripoll, E. Badisch, Proceedings ÖTG Symposium 2013, ISBN 978-3-901657-46-7.

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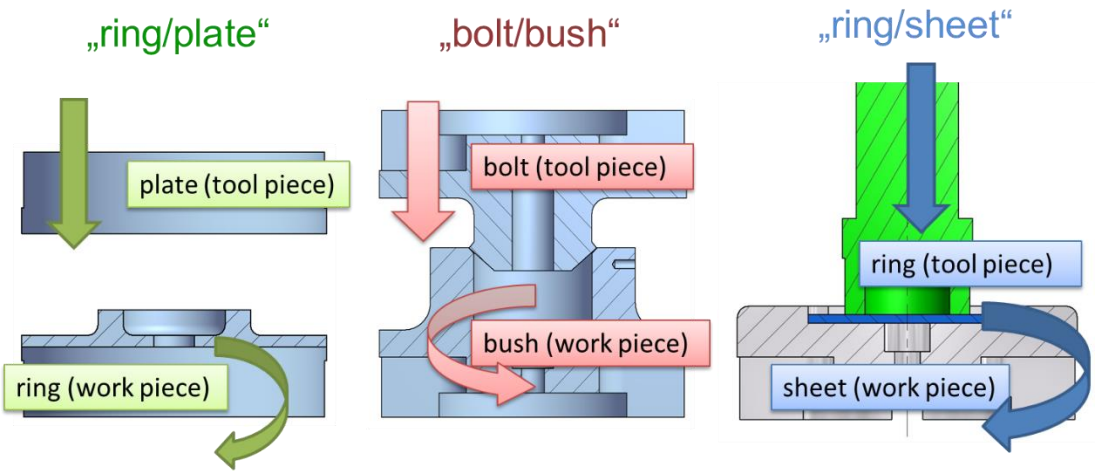
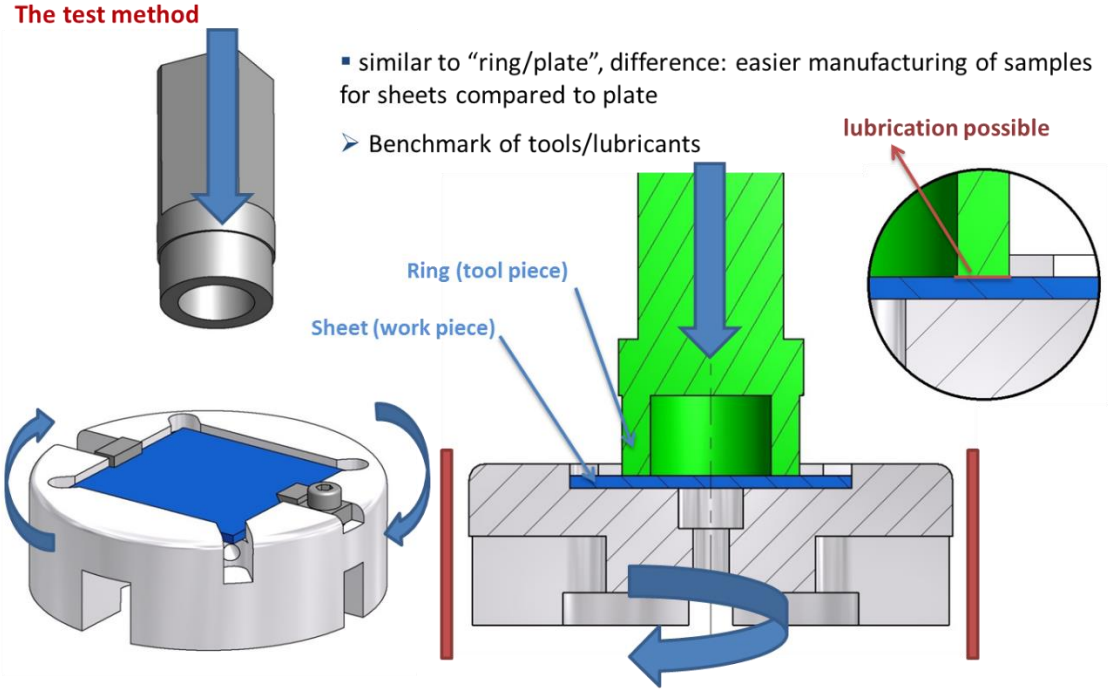


- Measuring of friction as function of deformation
- Lubrication

- Simulation of interupted contact

- for „reduced material“
- lubrication possible

The test method



- similar to “ring/plate”, difference: easier manufacturing of samples for sheets compared to plate

- Benchmark of tools/lubricants

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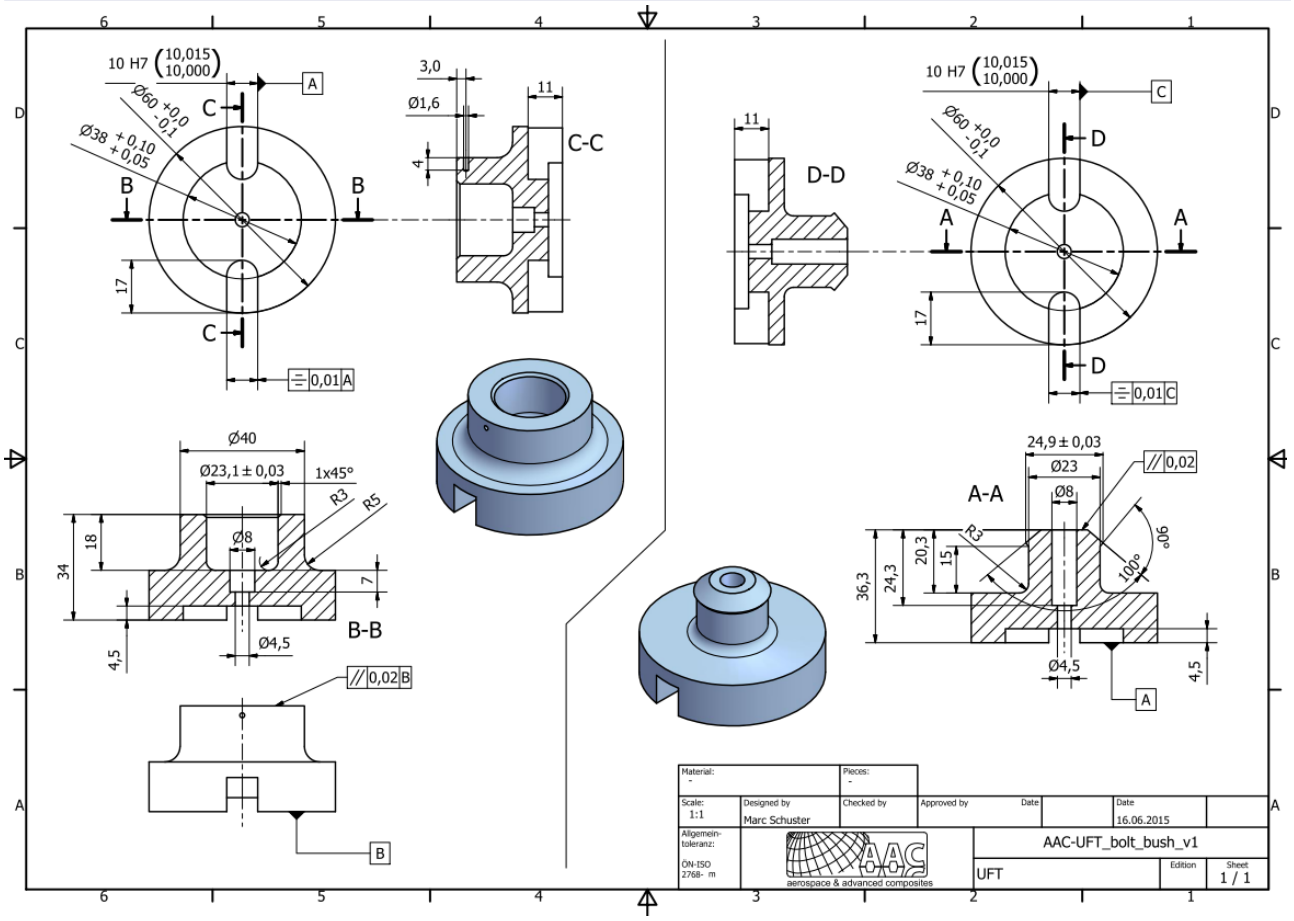

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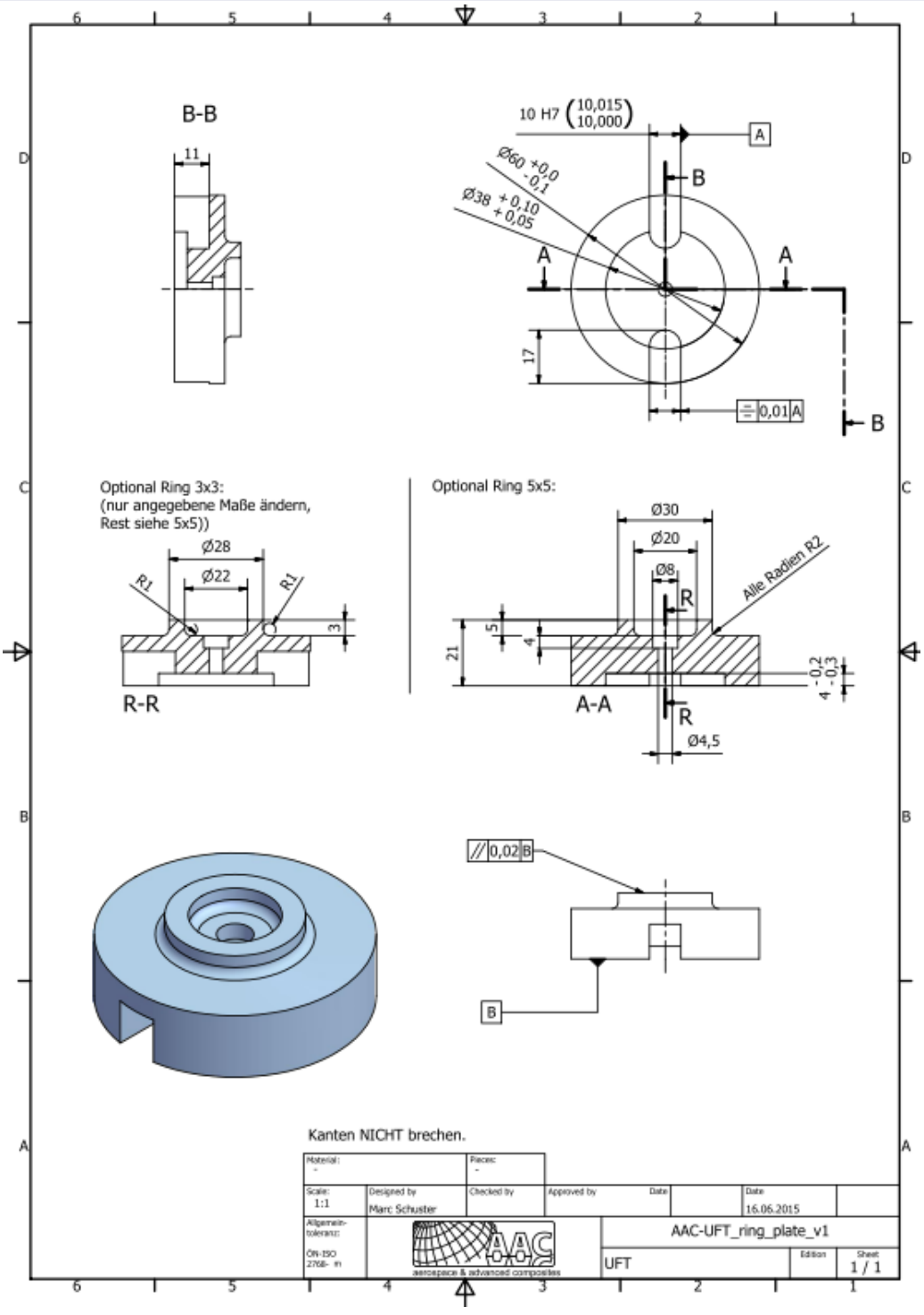

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