framatome

Hot Cells and Semi-Hot Cells

Materials Testing, Specimens Manufacturing, and Metallographic Examinations

Challenge

Materials and fracture toughness testing as well as metallographic examinations and failure analysis of mechanical components are very specific tasks. They require the flexible and versatile combination of many mechanical-technological methods, machines and equipment. Particularly for contaminated and / or activated material, the requirements are very high, especially regarding handling and radiation protection.

Solution

The Hot Cells Facilities at the Radiochemical Laboratory in Erlangen meet those requirements and provide excellent infrastructure and highly experienced professionals for these challenging tasks. We are well experienced with the following:

Materials testing

- Material testing of different standard specimens as well as fracture mechanics specimens for metallic materials, particularly for reactor pressure vessels surveillance programs according to international standards
- Material examination and testing of components
- Relaxation measurements on springs and bending specimens
- Non-destructive material testing for crack determination
- Radiation resistance tests on plastics and adhesive joints as well as cable insulation and cable coating materials

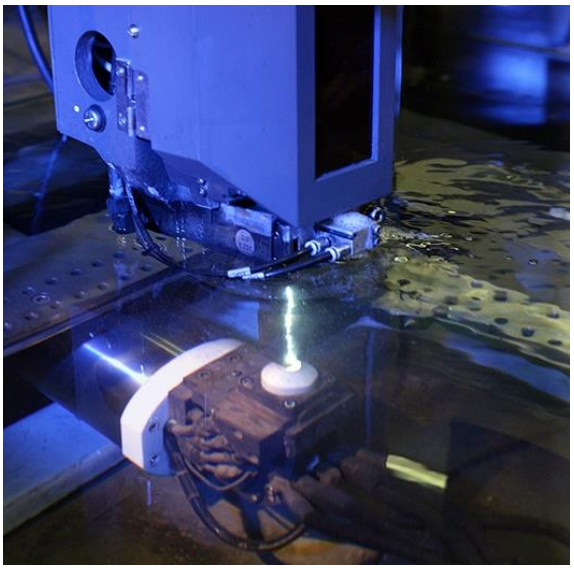
Specimens manufacturing

- Manufacturing of, e.g., Charpy, fracture mechanics and tensile specimens using state of the art equipment
- Manufacturing of reconstituted specimens with electron beam welding inside Hot Cells
- Complete manufacturing up to the introduction of mechanical and fatigue cracks for fracture mechanics specimens, dimension measurements by digital photography

Metallographic examinations

- Component failure analysis / root cause analysis of failed parts especially for contaminated and / or activated materials
- Microstructure examinations on metallic materials by means of SEM, FIB, TEM and Nanoindentation

Single-edge-bend bar testing device in the hot cells



Wire erosion technique for the preparation of specimens

Customer benefits

- Reliable results through longstanding experience in the field of mechanical material testing and experimental fracture mechanics
- Short response times even for complex test setups
- High quality results by our qualified experts

Your performance
is **our** everyday **commitment**

Technical information

The Hot Cell Facilities gather a rather versatile and complex spectrum of methods for mechanical and metallographic examination and connected tasks:

Testing machines, equipment in cells / exhausters

- 300 J Impact testing machine, standard test temperatures -150 °C up to +350 °C
- Universal testing machines with forces between 5 kN and 600 kN, standard test temperatures -150°C up to +350 °C
- Resonance pulsator up to 20 kN and 220 Hz for fatigue pre-cracking of fracture mechanics specimens
- Optical systems for fracture surface evaluation, crack propagation measurement

Machines, equipment in cells / exhausters

- Electrical discharge machines (wire-guided)
- CNC-controlled milling and drilling machine with automatic 16-fold tool changing mechanism
- Turning lathes, milling machines
- Electron beam welding machine for welding depths up to 110 mm
- Diamond wire saw, cut widths 0.15 mm up to 0.7 mm diamond, circular, belt saws

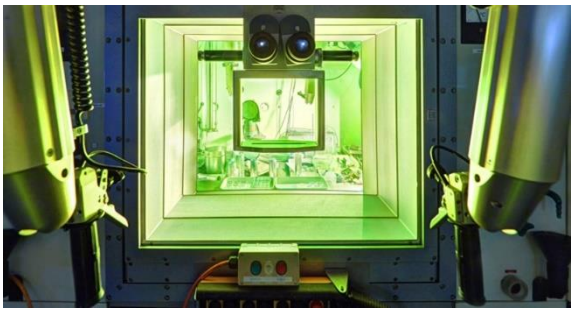
Apparatuses and equipment in cells / exhausters

- Hardness tester for different testing ranges: micro, low load, macro
- Grinding and polishing tools as well as etching equipment
- Metallography microscopes with magnification of up to 1000, stereo microscopes with magnification of up to 50, each with digital camera systems
- Cutting and abrasive equipment (diamond abrasive cut-off, diamond wire saw, other saws)

The Technical Center of Framatome Germany is a center of competence in the field of mechanical material testing and experimental fracture mechanics. Our test labs are accredited according to DIN EN ISO/IEC 17025:2018 *)

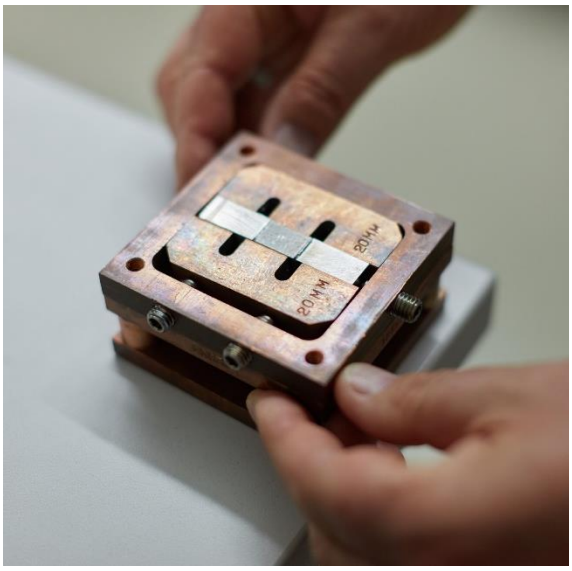
ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-21039-03-00

*) the accreditation is valid only for the scope as listed in appendix of certificate D-PL-21039-03-00 and in list of test methods: https://www.dakks.de/de/akkreditierte-stellen-suche.html; https://www.framatome.com/EN/customer-1668/certificates-and-accreditations.html



Sample preparation in the hot cells

Specimen manufacturing in the hot cells



Electron beam welding device for reconstituted specimen manufacturing in the hot cells

Key figures

Hot cells allow handling up to **10^{14} Bq**

2 material testing cells

3 metallography / chemistry cells

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