

TU Bergakademie Freiberg
29. November 2010

Remarks on small punch testing experience at IPM Brno



Petr Dymáček

Institute of Physics of Materials,
Academy of Sciences of the Czech Republic
Creep of metallic materials group
pdymacek@ipm.cz

Institute of Physics of Materials of the Academy of Sciences of the Czech Republic



- **1955:** Laboratory for the Study of the Properties of Metals of the CS AS
- 1963: Institute of the Properties of Metals of the CS AS
- 1969: Institute of Physical Metallurgy of the CS AS (1990 approx. 210 employees)
- 1994: Institute of Physics of Materials of the AS CR

at present: **approx. 120 employees , 50 scientists**

Institute of Physics of Materials of the Academy of Sciences of the Czech Republic

<http://www.ipm.cz>



Technical department:
- including own workshop

8 scientific groups:

Advanced High-temperature Materials Group

Brittle Fracture Group

Creep of Metallic Materials Group

High Cycle Fatigue Group

Low Cycle Fatigue Group

Diffusion and Thermodynamics Group

Electrical and Magnetic Properties Group

Structure of Phases Group

Institute of Physics of Materials of the Academy of Sciences of the Czech Republic



The work of the Institute is focused on the interdisciplinary field of materials science. The major work is carried out in **basic research** on metallic materials. The Institute is concerned with the **physical nature of processes** occurring in metallic materials during **creep, fatigue and interaction of creep with fatigue** and other types of mechanical loading, and with **research on the structure and selected physical properties of materials**. In both these fields, an attempt is made to elucidate the **relationship between the behavior** and properties of materials **and** their **structural** and microstructural **characteristics**.

Creep of Metallic Materials Group

- at present 4 scientific co-workers, 2 technicians

basic mechanisms of high temperature creep in metallic materials, relations between creep behaviour and microstructure and to a transfer of obtained results to technical applications. Experiments include conventional and non-conventional creep tests and structure investigations. The development of new testing facilities and procedures has resulted in a unique equipment of creep laboratories of the Institute.

TOPICS:

Basic research:

- *constitutive description of creep behavior*
- *constant structure creep*
- *creep in modern magnesium alloys and their fiber strengthened composites*
- *creep of intermetallics (Fe-Al)*
- *mechanisms of creep in metallic materials at very low creep rates*

Technical problems:

- *possibilities of small punch testing in investigations of mechanical behavior of metallic materials*
- *small punch test method assessment of the residual creep life of service exposed components (including welds)*
- *actual problems*

Creep laboratories

- a) **24** creep machines of own construction allowing
- either **tensile** creep tests under constant **load**
 - or **tensile** creep tests under constant **stress** *easy to change!!*
 - or **compressive** creep tests under constant **load**
- maximum load - 8000 N, temperatures from 100 to 1000 °C, possibility of protective atmosphere
- b) **5** creep machines of own construction
- **compressive** creep tests under constant **stress**
- maximum load - 8000 N, temperatures from 100 to 1000 °C, possibility of protective atmosphere
- c) **3** machines for
- creep tests with the possibility of **quick cooling under stress** (load)
 - at present adapted for **both types of SPT**
- d) during 2012-13 is planned purchase of **2** creep machines, 1 vacuum furnace up to 1600 °C, 1 protective atmosphere up to 1200 °C (within CEITEC research center)
- Continual recording** of all tests - PC - **own software** allowing also recording *some non-conventional tests (e.g., response to σ - or T changes)*

Creep laboratories

Creep laboratories:
in four rooms



Creep laboratories

