CELOÚSTAVNÍ SEMINÁŘ
Ústavu fyziky materiálů AV ČR

dne **11.5.2011** (středa) v **10:00 h**
v přednáškovém sále (4. patro)
Ústavu fyziky materiálů AV ČR, Žižkova 22, Brno

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Dislocation kinetics in Fe and Fe alloys investigated by in situ TEM straining experiments

In situ experiments have been carried out in pure Fe, in order to check the validity of the most recent ab-initio atomistic calculations of the core structure of screw dislocations, and to study the change of mechanism which is expected to occur at around 250K. Microsamples have been strained in a JEOL 2010HC transmission microscope, using room-temperature and nitrogen-cooled GATAN devices. Results will be illustrated by dynamic sequences. At room temperature, and in agreement with the kink-pair mechanism, dislocation exhibit straight screw portions moving slowly and steadily, and curved non-screw ones with a much higher mobility (Fig. 1). At low temperatures, the motion of screw dislocations becomes jerky (Fig. 2). The frame-by-frame analysis of this jerky motion shows that it cannot results in the same kink-pair motion mechanism as at room temperature. The softening effect of carbon and the hardening effect of silicon and chromium are shown to result from the shift of the transition between the two mechanisms to lower and higher temperatures, respectively.

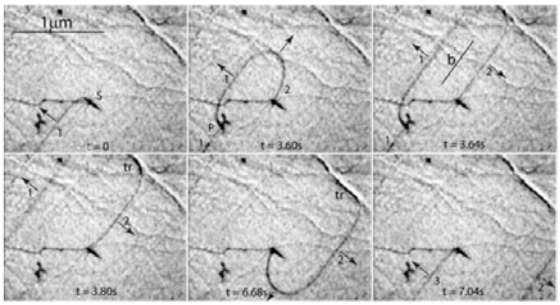

Fig. 1: Dislocation source in Fe at 300 K. The steady motion is typical of a kink-pair Peierls mechanism.

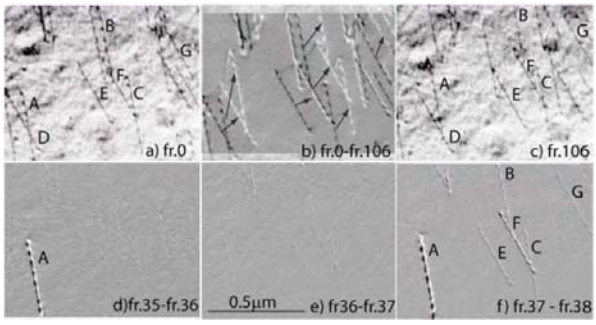

Fig. 2: Jerky motion of screw dislocations in Fe at 100 K. (b) is the difference between the initial (a) and final (c) images. (d)-(f) illustrates the jerky motion.

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