ESRF	**Experiment title:** Slip systems and Burgers Vectors in Hexagonal Metals, Especially Ti and Zr, Determined by Extracting Single Crystal Data from Polycrystalline Samples	**Experiment number**: MA-36
Beamline: ID11	**Date of experiment**: from: 05 July, 2006 to: 10 July, 2006	**Date of report**: 19 October, 2006
Shifts: 15	**Local contact(s)**: Gavin Vaughan, ID11	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Tamás Ungár[1], , Krisztian Nyilas[1], Levente Balogh[1], Gavin Vaughan[2]
[1]Department of Materials Physics, Eötvös University Budapest, Hungary,
[2]ESRF, ID11, Grenoble

Report:

Thin-rod specimens of a few tenths of mm diameter and about 5 mm length were prepared from Ti and Zr deformed to different extent in compression, consecutively from three different perpendicular directions. The specimens were hit by a beam of about 50 μm diameter and small divergence. The scattered radiation was detected by the high resolution area detector of 50 μm pixel size and 100x100 mm opening at a distance from the specimen at 300 mm in the *close-mode*, and 700 mm in the high resolution, *far-mode*, respectively. In the far-mode the detector was moved to 3x3=9 positions in a matrix, in order to cover a larger area in reciprocal space. The specimen was rotated over the ω axis by Δω steps of 0.2^o and 0.5^o over $\pm 60^o$ in the close and the far-modes, respectively. In the close or far modes the diffraction pattern were measured in each ω setting for 1 or 8 seconds, and 240 and 600 frames were stored for the two modes, respectively. In the far-mode 600 frames were recorded in each detector position in the 3x3 detector position matrix. Two typical close frames are shown in Figs. 1a and 1b, corresponding to one of the less deformed Ti specimen. The diffraction spots are strongly elongated along the Debye-Scherrer rings indicating the presence of mosaicity and microstrains. In Fig. 1c the close-mode frames are summed up. Along the innermost ring a well developed six fold symmetry of the diffraction spots indicates a texture in the specimen. Here we note that, in the case of the present figure, one diffraction spot corresponds to a large number of individual grains, or a large number of spots on the individual frames. A typical readout of an individual frame in the high resolution far-mode, i.e. at a 700 mm detector to specimen distance, is shown in Fig. 1d. In a blow-up in Fig. 2 it can be seen that the resolution is good enough for the evaluation of line broadening even in the radial direction. The orientation matrix has been determined for most of the measured specimens on the basis of the close-mode diffraction patterns by using the software available at the beamline. At present a software is being developed for the purpose of finding the one-to-one correpation between the diffraction spots on the close-mode and the far-mode patterns. This correlation is crucial in order to transfer the orientation matrix from the close-mode to the far-mode data. Once this software is available, the individual, single crystal diffraction spots will be evaluated for the three dimensional intensity distribution in reciprocal space.

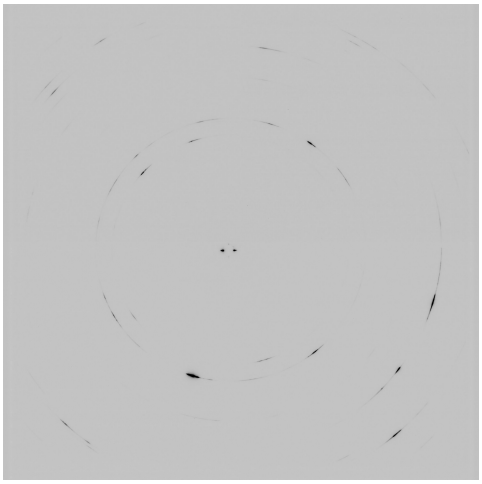

Figure 1a. Typical single frame of the less deformed Ti specimen in the close-mode detector position, i.e. specimen to detector distance 200 mm.

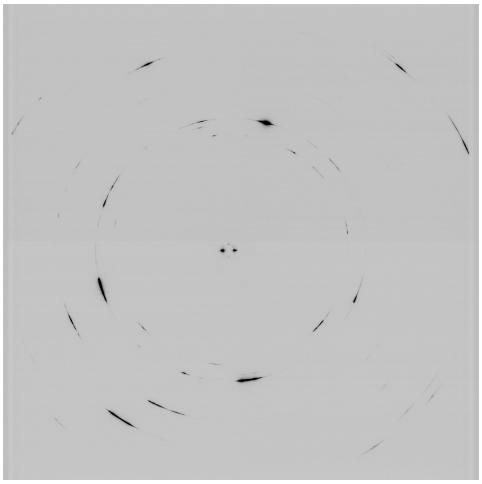

Figure 1b. Typical single frame of the less deformed Ti specimen at a different ω setting as compared to the frame in Fig. 1a.

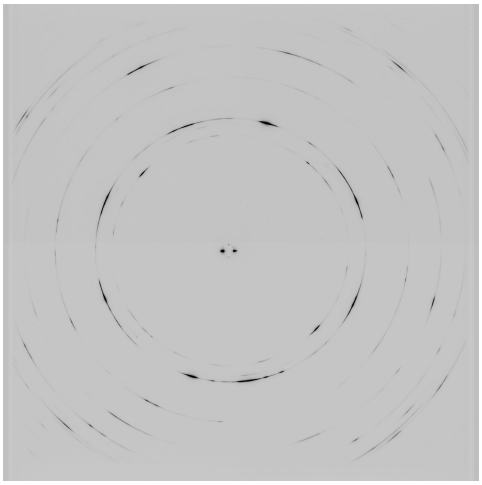

Figure 1c. Diffraction pattern after the summation of all the individual close-mode frames corresponding to the less deformed Ti specimen.

Figure 1d. Typical single frame of the less deformed Ti specimen in the high resolution, i.e. far-mode detector position, specimen to detector distance 700 mm.

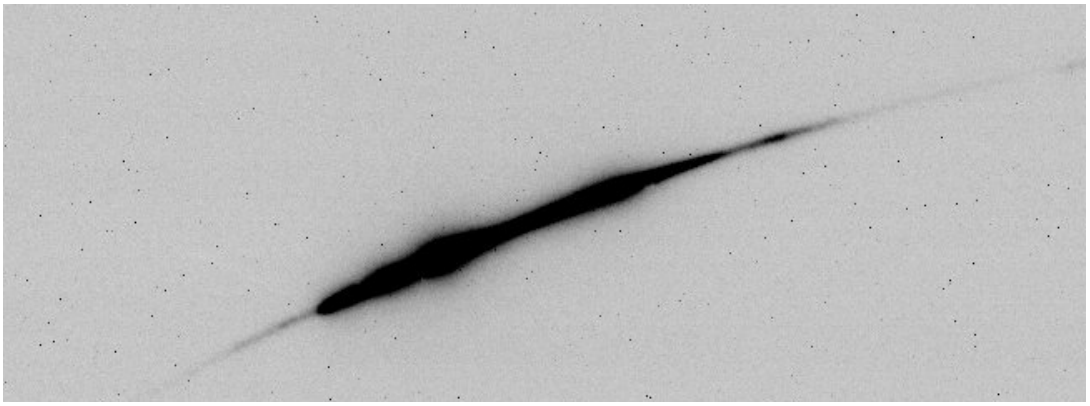

Figure 2. Blow-up of one of the diffraction spots in the lower part of Fig. 1d. The strong elongation along the Debye-Scherrer ring indicates large Rocking-curve broadening due to mosaicity in the deformed specimen. At the sametime, considereble radial broadening can be seen which is due to the presence of dislocations in the crystal. Peak broadening, even in the radial direction, is far larger than the resolution of the detector, hopefully allowing line profile analysis on the individual, "single crystal" diffraction spots.