ESRF	**Experiment title:** Texture evolution during hot deformation of magnesium alloys	**Experiment number**: MA-740
Beamline:	**Date of experiment**: from: July 1st, 2009 to: July 4th, 2009	**Date of report**:
Shifts:	**Local contact(s)**: Dr. John Elliot Daniels	*Received at ESRF:*

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Report:

The present work examines the influcence of alloying systems and the initial texture on the deformaion behaviour of magnesium alloys under tensile loading at different temperatures. By analysing the texture evolution during the deformation, the activities of different deformation mechanisms can be analysed. Round tensile samples were machined in 3 different sample orientations, 0°, 45° and 90° to the extrusion direction (ED), from extruded rectangular profiles from alloys AZ31 (Mg - 3Al - 1Zn - 0.3Mn in wt.%) and ZE10 (Mg - 1Zn - <1 rare earth elements) alloys. The tensile tests were carried out at room temperature, 150°C, 200°C and 250°C with the initial strain rate of 10^{-3}/s. To examine the texture evolution during the tensile deformation, the loading was stopped after reaching certain strain degrees, e.g. at yield point, strain hardening stage and at maximal strength, as well as after fracture. Thereafter, the samples were immediately taken out from the tensile testing machine and water quenched. The texture of the samples deformed to different strain values were measured using monochromatic hard X-rays at the beamline ID15 at ESRF.

This report presents and compares the texture evolutions of the 90° (to the ED) samples deformed at room temperature and 200°C, as a preliminary results. The stress-strain curves of the AZ31 and ZE10 alloys and corresponding sample coordinates are shown in Fig. 1. The positions of the texture measurements are also indicated by the arrows on the stress-strain curves. Since the tensile behaviour of the samples deformed under the same condition to different strain values are very similar, only the curves achieved from the samples strained to the failures are presented in Fig. 1. Comparing the tensile behaviour between both alloys, the ZE10 samples are more ductile and show yield phenomena, whereas no yielding phenomena is found in the AZ31 samples.

The evolution of the texture is presented, in terms of recalculated $\{10\bar{1}0\}$ and (0002) pole figures, in Figs. 2 and 3 for the AZ31 and the ZE10 samples, repectively. In case of the tensile loading at the room temperature, the texture measured at the broken sample is presented in the present report. In all loading conditions, a new texture component which corresponds to the basal poles in the original ED is visible which is understodd as a result of $\{10\bar{1}2\}$ tensile twinning. Because the basal poles aligned in the tensile loading direction (marked with circles on the (0002) pole figures in Figs. 2 and 3) is favourable for the twinning activation and the twinning causes a 86° rotation of the basal pole around the $<11\bar{2}0>$ axis, the new texture component (marked with dashed circles in Figs. 2 and 3) appears and strengthens with increasing strain. However, the strenghtening degree of the newly formed texture component is less pronounced in the samples deformed at 200°C comparing to those deformed at room temperature. This indicates that the twinning activity is lower at elevated deformation temperature. Moreover, the $<10\bar{1}0>$ poles parallel to the loading direction (LD) are

formed with increasing the tensile strain. The formation of the <10$\bar{1}$0> component // LD is related to the twinning activity and the primatic <a> glide [1]. Interestingly, the ZE10 sample after fracture at 200°C shows a slight intensity of the basal poles tilted from the original ND (FND) to the LD. Similar changes are also found in the ZE10 sample after fracture at room temperature. From the results reported in the literature [2], it can be expected that this texture change is contributed from the pyramidal <c+a> glide. The following research will give its focus to understand the mechanism of the texture changes and responsible deformation modes, especially by the texture simulation based on the experimetal results.

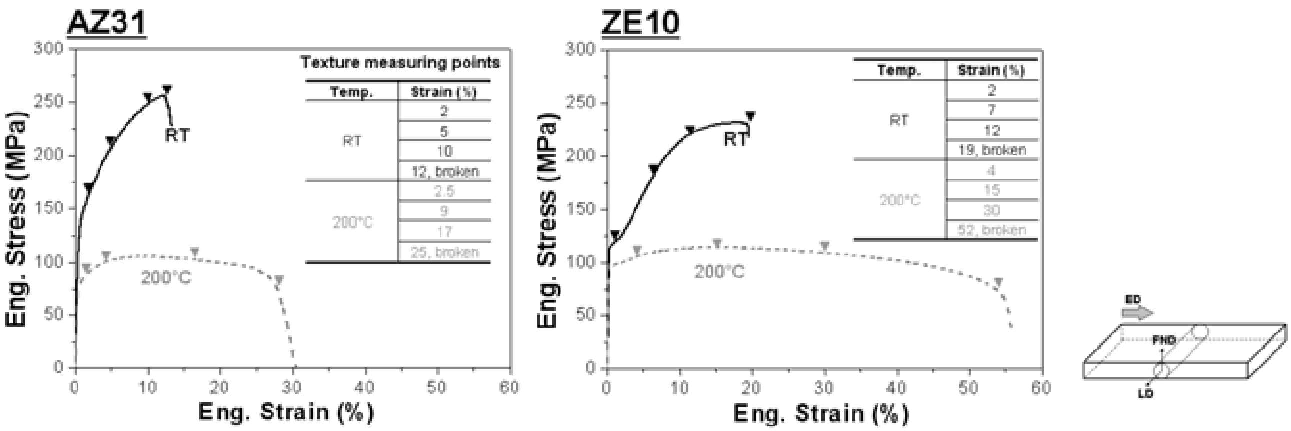

Figure 1. Stress-strain curves of AZ31 and ZE10 samples cut from 90° to the ED, under tensile loading at room temperature (RT) and 200°C. Texture measuring points, in terms of the strain values, and the sample coordinates are also presented.

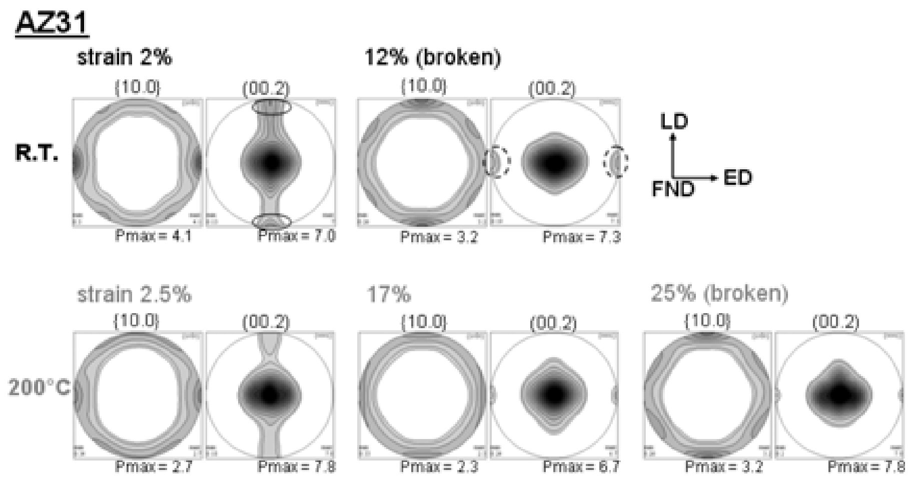

Figure 2. Texture evolution during tensile loading of AZ31 samples at RT and 200°C (Level=0.8, 1.0, 1.5, 2.0, …, 6).

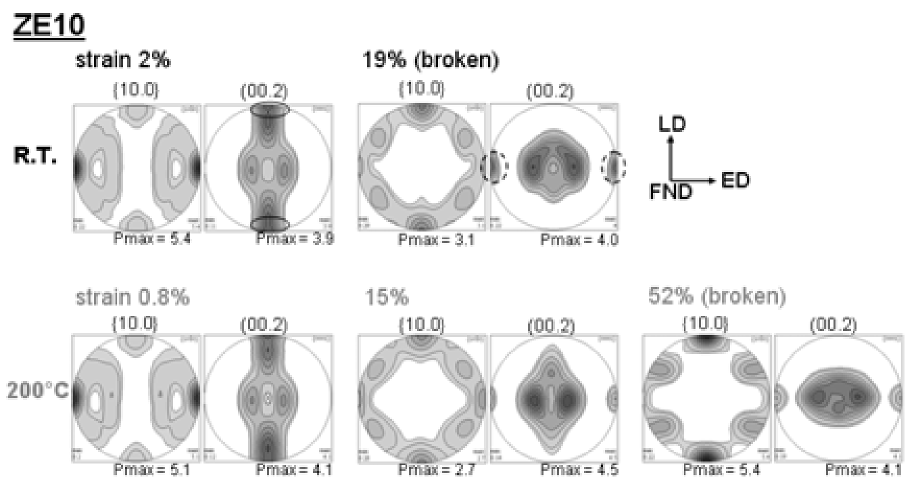

Figure 3. Texture evolution during tensile loading of ZE10 samples at RT and 200°C (Level=0.8, 1.0, 1.5, 2.0, …, 6).

[1] J. Koike, R. Ohyama, Acta Mater., Vol. 53, 2005, 1963

[2] S.R. Agnew, M.H. Yoo, C. Tome, Acta Mater., Vol. 49, 2001, 4277