（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

| MLF Experimental Report | 提出日 Date of Report **2017/08/18** |
|---|---|
| 課題番号 Project No. **2014A0267**<br>実験課題名 Title of experiment<br>In-situ investigation on microstructure rearrangements and defect kinetics in magnesium and aluminuim alloys<br>実験責任者名 Name of principal investigator<br>Klaus-Dieter Liss<br>所属 Affiliation<br>Australian Nuclear Science and Technology Organisation | 装置責任者 Name of responsible person<br>Stefanus Harjo, Kazuya Aizawa<br>装置名 Name of Instrument/（BL No.）<br>TAKUMI / BL19<br>実施日 Date of Experiment<br>2014/05/11 9:00-2015/05/13 9:00<br>experimental team<br>Klaus-Dieter Liss, Pingguang Xu, Stefanus Harjo, Kazuya Aizawa, Wu Gong, Takiro Kawasaki; (samples: Eitaro Yukutake; Bob Harrison) |

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）
Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

Experiment ID and run numbers are listed in Table 1 and the run date in Figure 1.

| exID | runNo | sample_name |
|---|---|---|
| 5340 | 22674 | S01-Mg-pure-deformed |
| 5341 | 22675 | S02-Al-1370 |
| 5342 | 22676 | S03-Al-1370 |
| 5343 | 22677 | S04-Cu-electric-deformed |
| 5344 | 22678 | S05-Cu-electric-Non-deformed |
| 5345 | 22679 | S06-Ti-Grad2-Non-deformed |
| 5346 | 22680 | S07-Ti-Grad2-Non-deformed |
| 5347 | 22681 | S08-Mg-AZ31 |
| 5348 | 22682 | S09-Mg-AZ91 |
| 5349 | 22683 | S10-Mg-AZX41 |
| 5350 | 22684 | S11-Mg-Pure |
| 5351 | 22685 | S12-Mg-Pure |
| 5352 | 22686 | S13-Al-2011-deformed |
| 5353 | 22687 | S14-Al-3.8Cu-deformed |
| 5354 | 22688 | S15-Al-10Sr-deformed |
| 5355 | 22689 | S16-Zr-2.5Nb-Nondeformed |
| | 22249 | Vanadium-pattern |

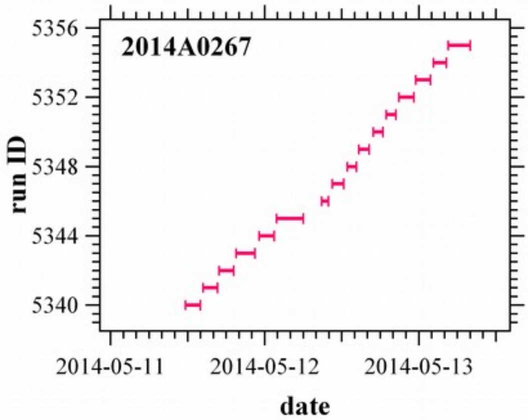


**Figure 1:** Experiment ID displayed along experimental time showing effective usage of the beam time.

**Table 1** (left)

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

Goal of the experiment was to extract microstructural and crystallographic parameters from the recorded diffractograms. This can reflect in various parameters, namely peak position $G$, shape, e.g. width $\Delta H$ and intensity $R$. Upon heating and cooling, typical lattice strain $\varepsilon = -\Delta G/G$ is dominated by linear thermal expansion, change of phase composition, order parameter and relaxation of residual stresses. The width D*H* reduces when intergranular strains relax, e.g. during defect annihilation and upon recrystallization. Intensity changes are related not only to phase transformations and preferred orientation evolutions, but also to the amount of defects in a nearly perfect crystallite, as they may occur at high temperature.

The specimens listed in Table 1 have been measured in-situ in the diffraction dilatometer upon a heating and cooling cycle. Most of the specimens were cylindric, 12 mm high and 8 mm diameter, unless produced from sheet material. In order to introduce more defects as starting conditions, some cylinders have been compressed by hammering on an anvil, to typical 8-9 mm height as feasible. Deformed and un-deformed samples have been run for comparison. The sample axis has been mounted in diagonal axis such that the integrated detector arrays 0001 and 0000 probe for scattering vectors in longitudinal and transverse direction according to **L** = 南 = SOUTH = 0001 and **T** = 北 = NORTH = 0000, respectively.

The provided vanadium pattern for each detector bench have been fitted by $16^{th}$-order polynomials in order to smoothen the counting statistics, which then were taken to normalize each measured time-of-flight diffraction pattern channel by channel. The instrument was calibrated to be momentum transfer $Q = 2\pi / (TOF/15000)$, where TOF is the time-of-flight channel number in the data collection. Dilatometer data were stored in adjacent ASCII data files with ending *.CSV.

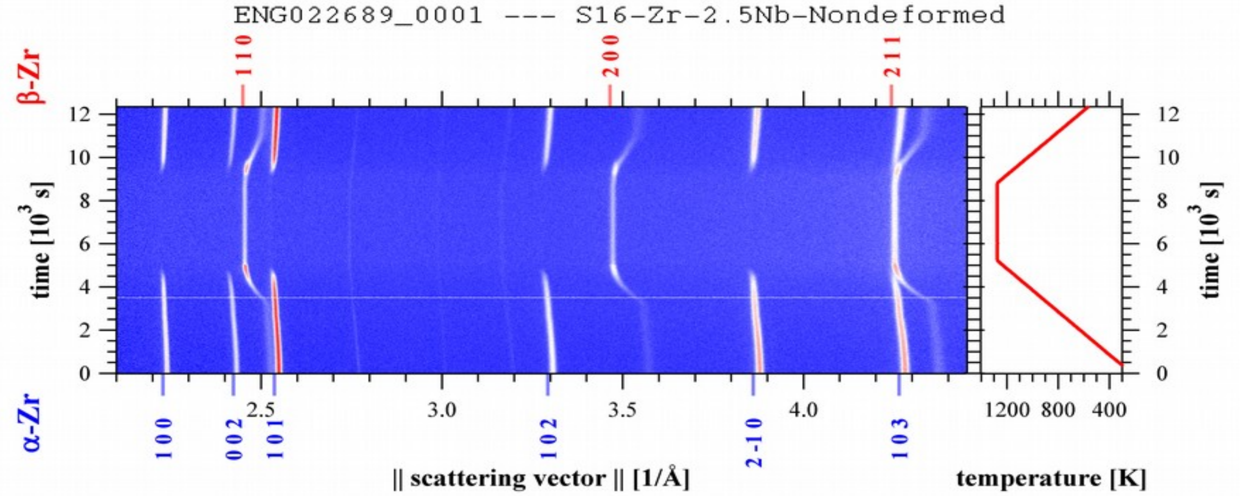


*Figure 2: Representative specimen-run after normalization and calibration.*

The run on Zr-2.5Nb shown in Figure 2 displays all the expected features, as thermal expansion, huge chemical strain in β-phase, peak widening, particularly in β-phase at low temperature, phase transformation and reflectivity change in β-phase at high temperature. The diffractograms have been fitted and the related microstructure evolution model has been established to quantify these changes with various structural parameters. Similar plots have been established for all examined specimens and further analysis will focus on each material one by one. KDL is actually taking up an academic university appointment, and a graduate student will join this research topic for further data analysis and modeling examination, aiming for the early academic publication.