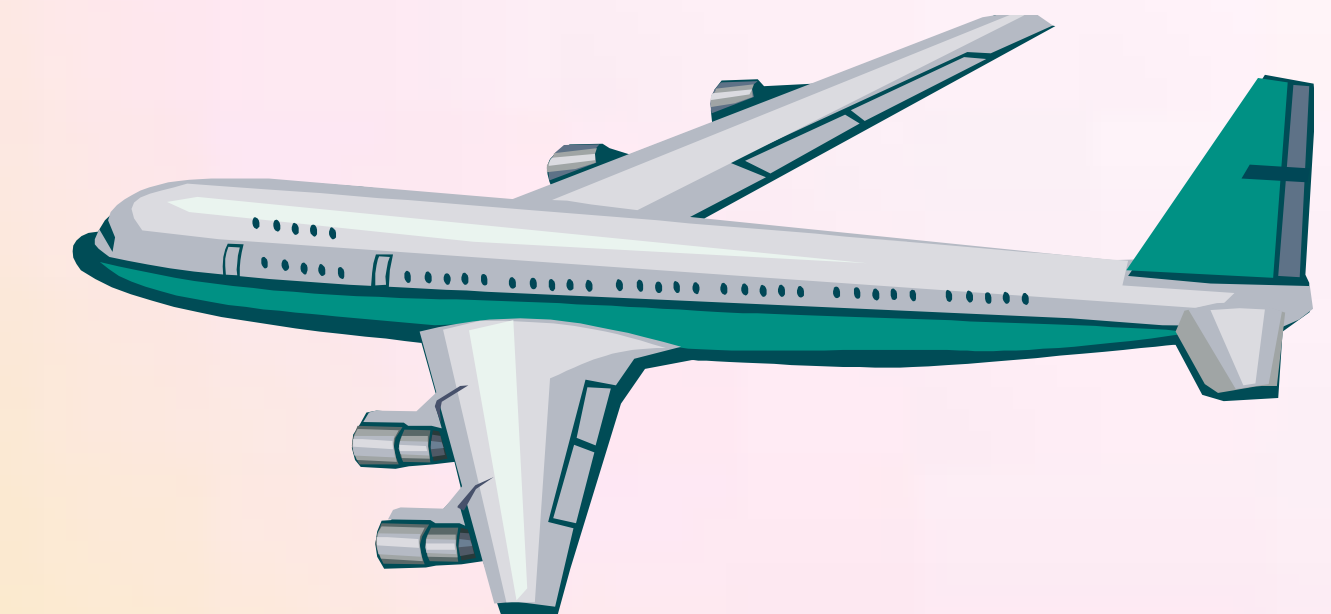
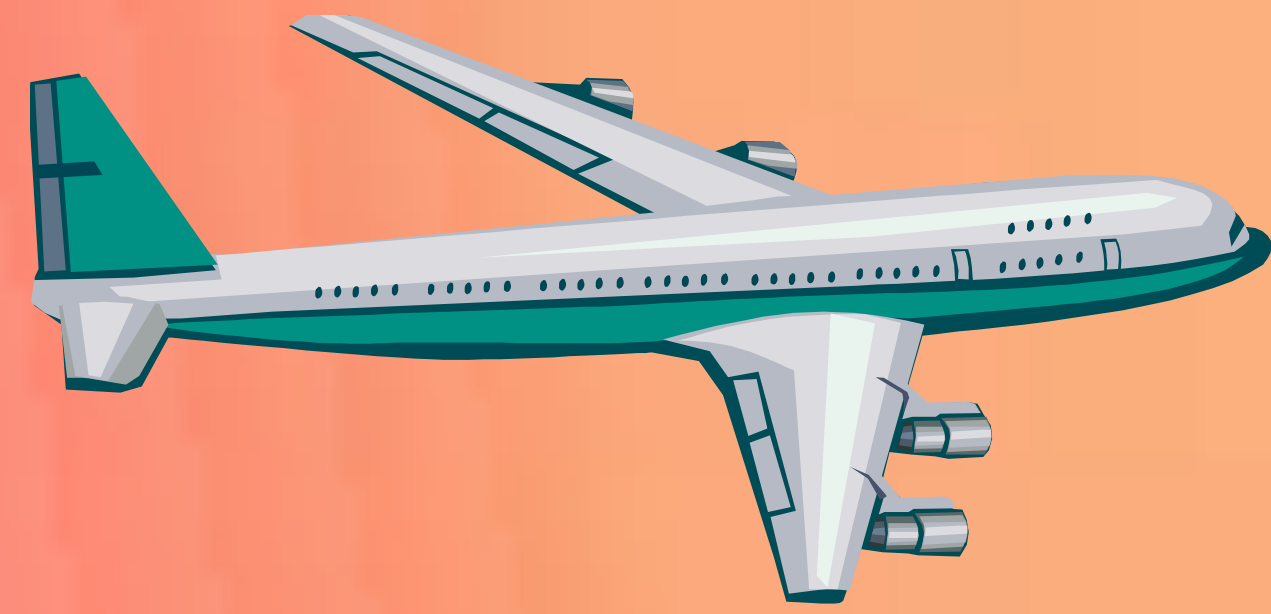


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MME REU Program

Background

Aluminum alloy 7050 is primarily used in aerospace applications. It is comprised of 2wt% Cu, 1.9wt% Mg, 5.7wt% Zn, 0.08wt% Zr, with traces of Si, Fe, Mn, Cr, and Ti, the rest of the wt% being Al. The inclusion of zirconium makes this alloy of particular interest.

Objectives

The goal of this project is to better understand recrystallization in Aluminum Alloy 7050 to be able to process this alloy more efficiently, in order to reduce the amount of energy and the cost of producing this alloy.

Experimental

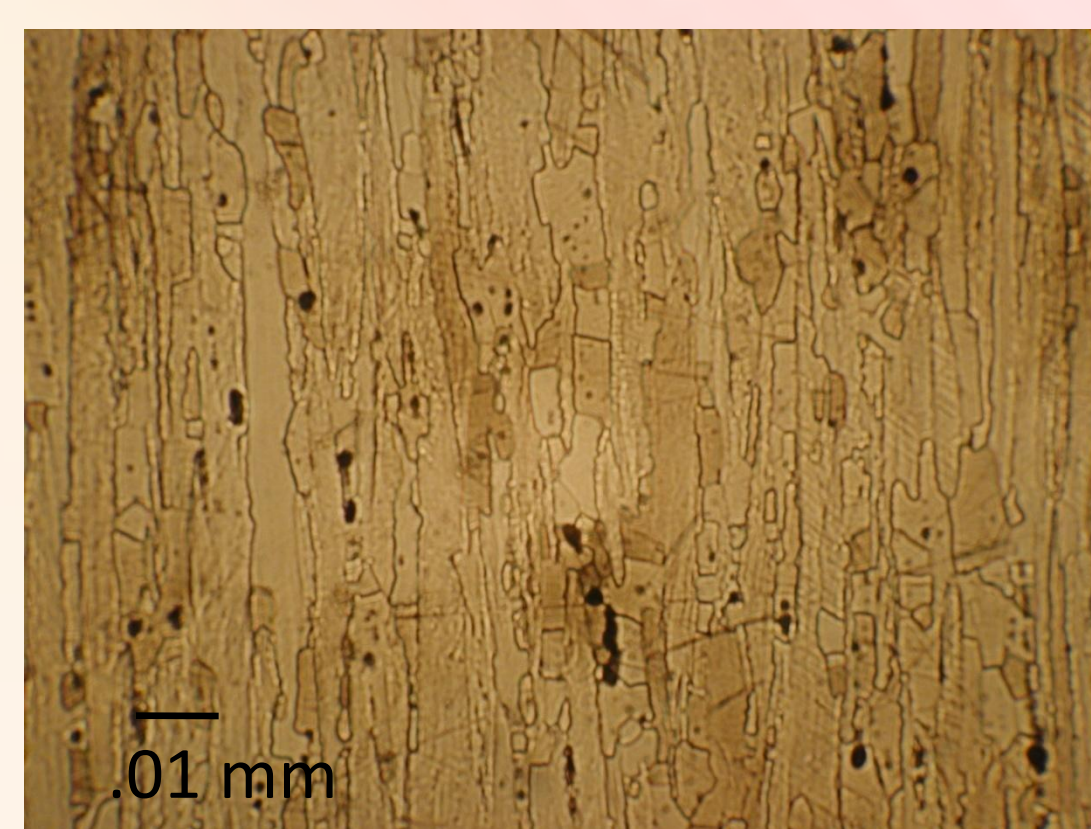
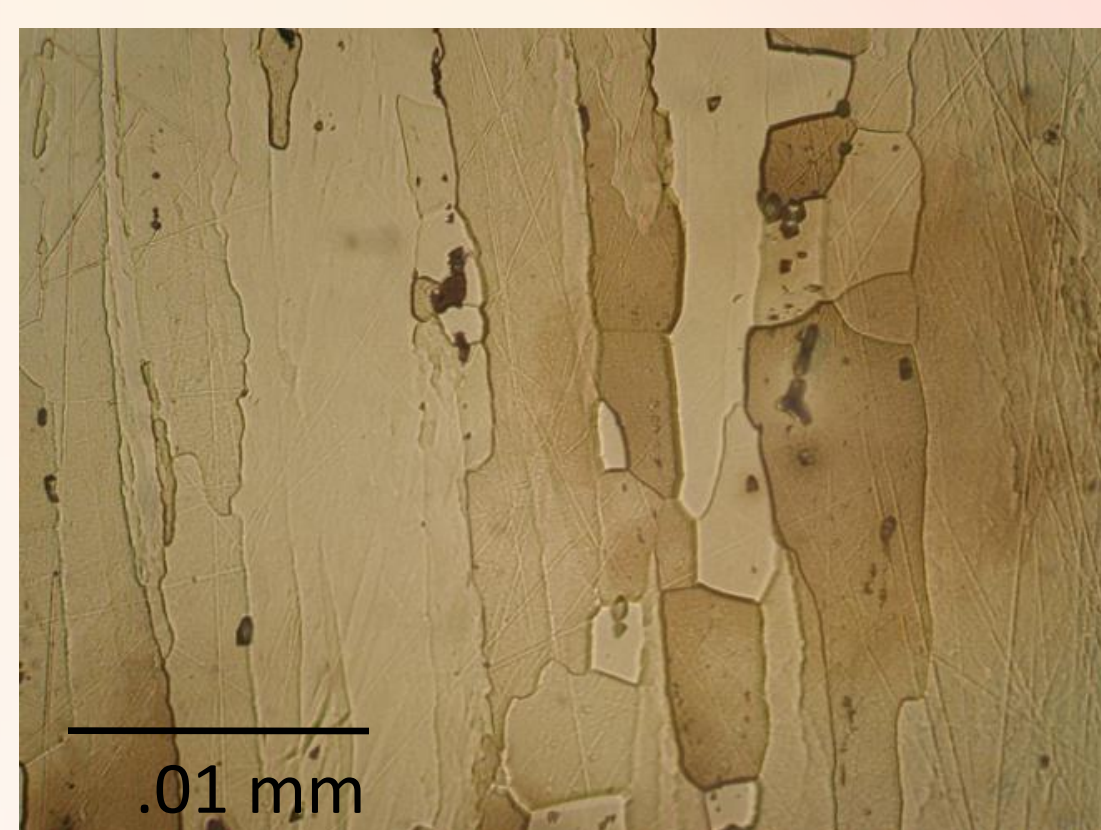
Cold Rolling

Specimens were cut from hot rolled Aluminum Alloy 7050. Further deformation of specimens was done by cold rolling. During the cold rolling process the defect known as alligatoring became a problem. This defect causes a material to fracture along the plane perpendicular to the highest tensile stress, which is parallel to the rollers. In the first set of samples alligatoring occurred at all strains more than about 10%. To prevent this defect, specimens were cut to a different thickness and rolled with many passes, i.e. 19 passes for 30% strain.

Annealing

After being rolled the specimens were then cut into smaller pieces using a diamond saw. Annealing was done in a salt bath at three different temperatures: 350°C, 450°C, and 500°C. Immediately after annealing specimens were quenched in water.

10% Strain Annealed at 500°C for 10 min



10% Strain Annealed at 500°C for 24 h

Grinding and Polishing

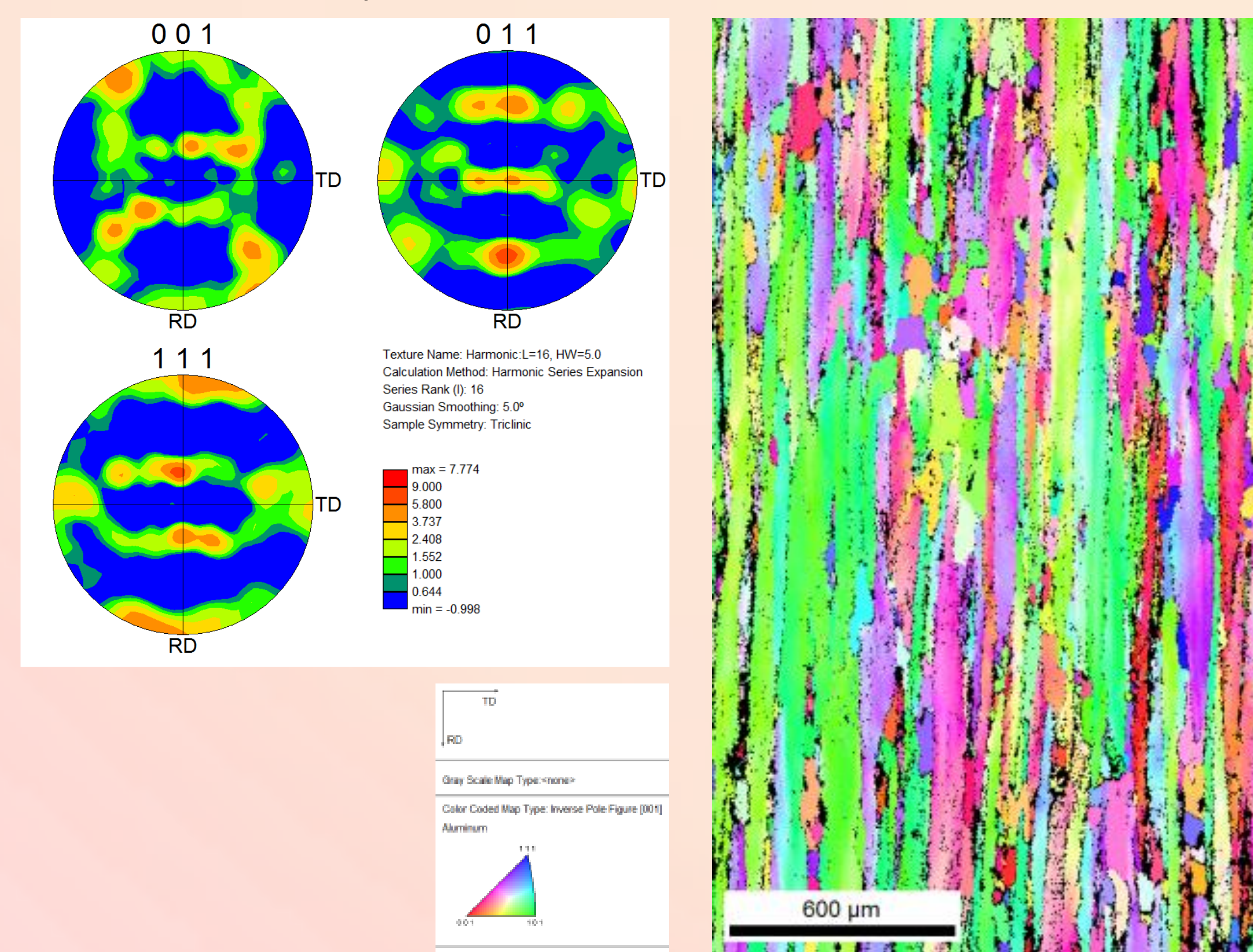
Grinding was done with silicon carbide sandpaper ranging from 120-1200 grit and polished with alumina 1 micron solution, 1 micron diamond paste, and 0.25 micron diamond paste. The final polish used on the samples was a 0.02 micron colloidal silica solution and was done by hand.

Imaging

Specimens were etched using Keller's Etch to obtain optical images. Specimens were then re-polished by repeating the last two steps of polishing. Electron backscatter diffraction (EBSD) was performed using a field emission scanning electron microscope (SEM). EBSD data were analyzed with OIM Analysis 5.1.

Results

10% Strain Annealed at 500°C for 10 min
Deformed Data Only

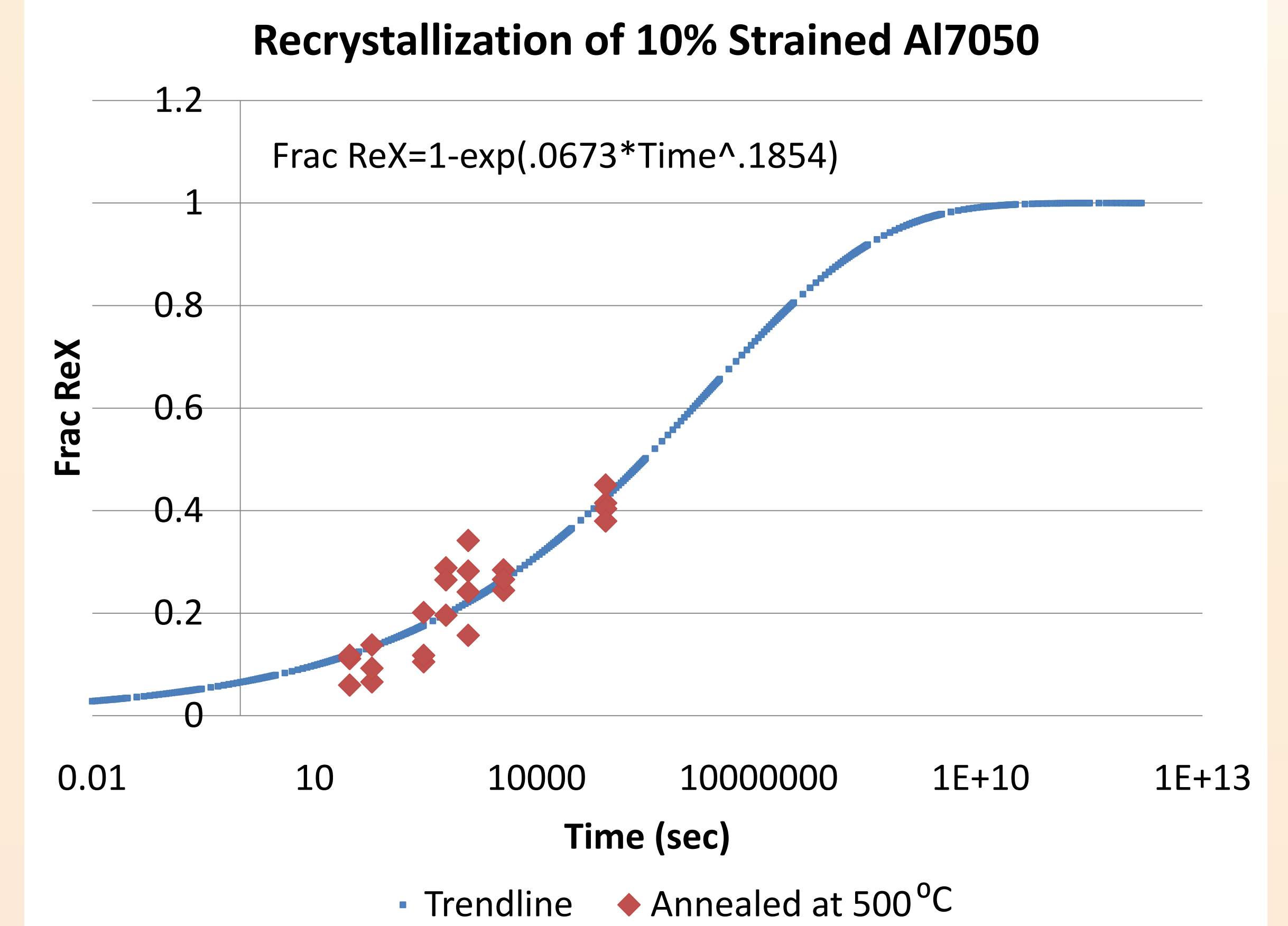


10% Strain Annealed at 500°C for 5 min

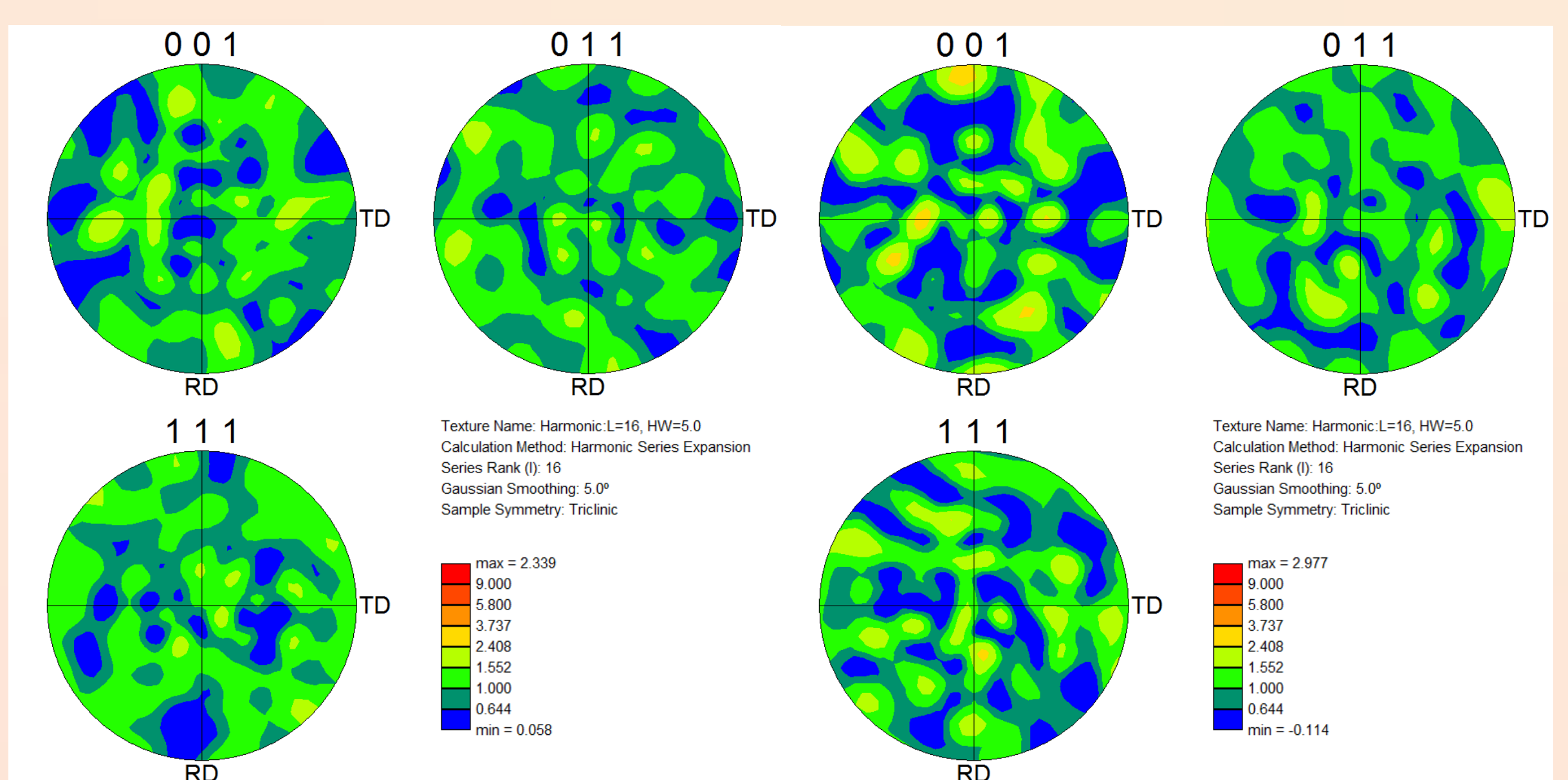
Results in the form of optical images and EBSD data, were used to create plots and pole figures. Through the optical images the recrystallization fraction was measured. Using OIM Analysis the EBSD data were separated into deformed or recrystallized grains according to the grain orientation spread. The separated data were used to create pole figures to show the texture of deformed and recrystallized grains.

Conclusions

As can be seen in the graph below, the recrystallization kinetics of 10% strained Al7050 are very slow for an annealing temperature of 500°C. The recrystallized texture of roll aluminum is expected to be a cube texture, {100} <001>. As shown in the pole figures below, the orientation of the recrystallized grains of Al7050 are random. The tortuous strain of the particles implies that the recrystallized grains nucleate near the particles within the alloy.



10% Strain Annealed at 500°C
Recrystallized Data Only



60 sec Anneal

20 min Anneal

Acknowledgements

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References

- J.D. Robson, Microstructural evolution in aluminum alloy 7050
- Fanyou Xie, A study of microstructure and microsegregation of aluminum 7050 alloy