Compressive Deformation Behaviour of WE54 Alloy

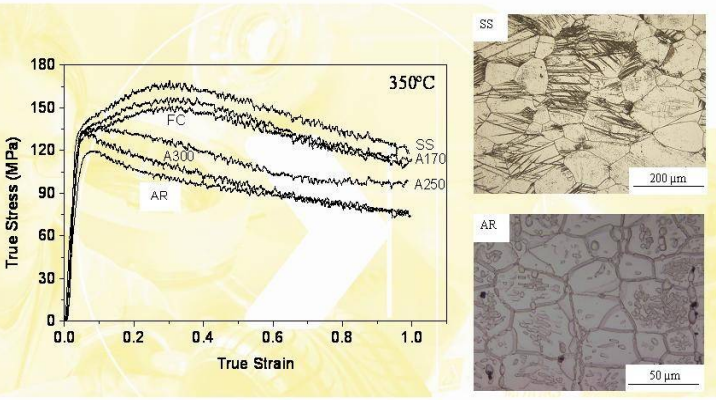
Hossein Beladi and Matthew R. Barnett

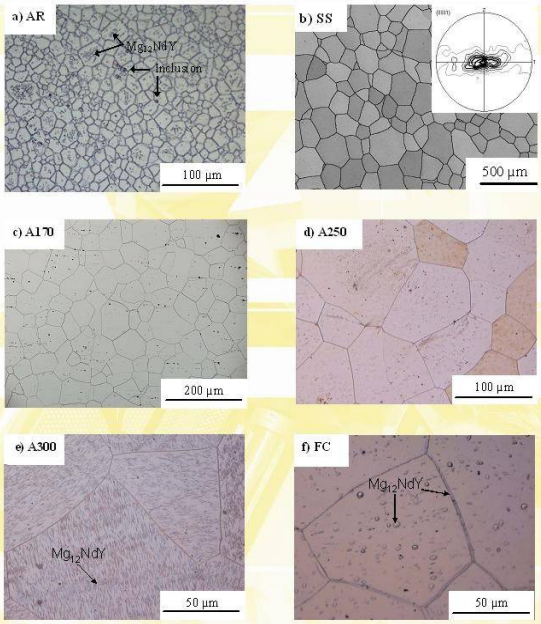
Centre for Material and Fibre Innovation, Deakin University, Geelong, VIC 3217

The effect of aging pre-treatment on the compressive deformation of a commercial WE54 alloy (i.e. Mg, 5-5.5%Y, 1.5-2%Nd, 1.5-2%RE) is studied. Age hardening treatments were performed at 170ºC, 250ºC and 300ºC. Compression testing was then carried out for the peak aged samples at temperatures between ambient and 450ºC.

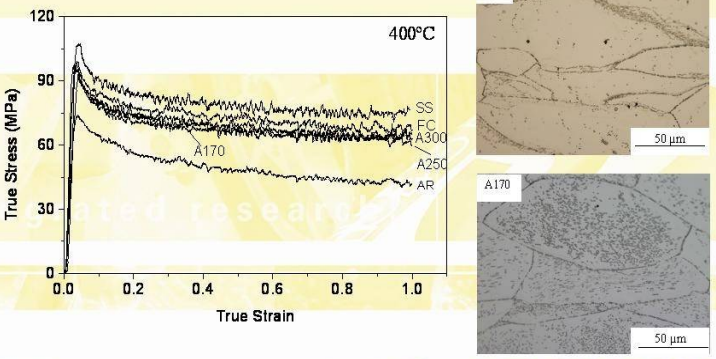
Heat treatment routes and related sample code

Code	Solid Solution Treatment		Aging Treatment	
	Temperature	Time	Temperature	Time
A170	525ºC	8h	170ºC	135h
A250	525ºC	8h	250ºC	16h
A300	525ºC	8h	300ºC	5h
SS	525ºC	8h	Solid Solution	
FC	525ºC	8h	Furnace Cooled	
AR	As-Received			





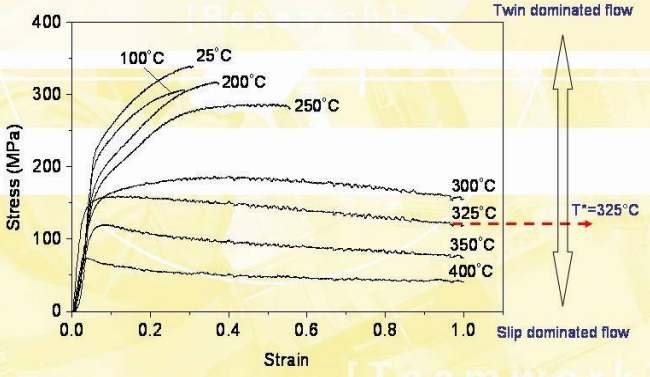
Microstructures of the present WE54 alloy after different heat treatment conditions



True stress-true strain curves for different heat treatment conditions

Critical temperatures for the transition in stress-strain behaviour for different heat treatment conditions

Microstructure	A170	A250	A300	SS	FC	AR
(grain size)	(140µm)	(140µm)	(140µm)	(140µm)	(140µm)	(10µm)
T*	375ºC	350ºC	325ºC	375ºC	375ºC	325ºC



True stress-true strain curves at different deformation temperatures for the AR specimen

Summary

- Aging alters the compressive stress during warm and hot working less than it does the hardness at room temperature.
- Aging pre-treatment changes the slip-twinning transition temperature by approximately 50ºC over the treatments employed here.
- Dynamic precipitation occurs during the hot working of peak aged samples.
- The absence of dynamic recrystallization in the present samples suggests that dynamic recrystallization in Mg alloys is sensitive to the retardation of boundary migration.