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Microanalysis



Characterization of nano-scale precipitates in Mg-2.8Nd-0.6Gd-0.2Zn-0.4Zr (wt.%) alloy

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Jiehua Li^{a, c}, Gang Sha^{a, b}, Tingyu Wang^a, Wanqi Jie^c and S.P. Ringer^{a, b}

^a Australian Key Centre for Microscopy and Microanalysis, The University of Sydney, Madsen Building F09, Sydney, NSW 2006, Australia

^b ARC Centre of Excellence for Design in Light Metals, The University of Sydney, NSW 2006, Australia

^c State Key Laboratory of Solidification Processing, Northwestern Polytechnical University, Xi 'an, 710072, China

jh.li@usyd.edu.au
www.emu.usyd.edu.au



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Mg-Nd-Gd-Zn-Zr

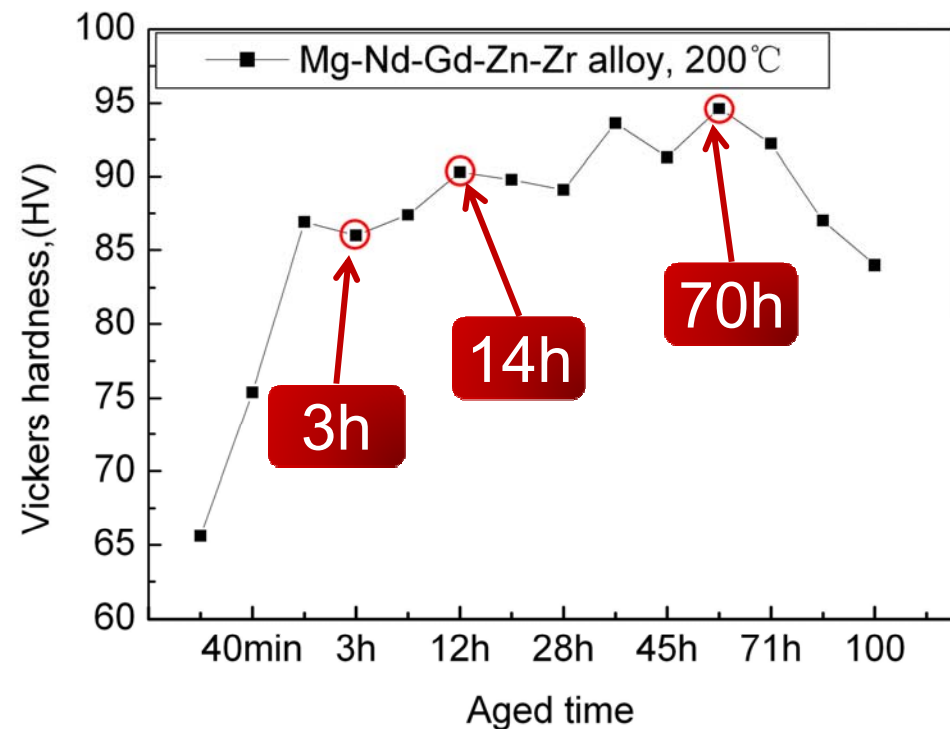
- ❑ ZM-6 alloy in China
- ❑ МЛ10 alloy in Russia
- ❑ The poorer higher temperature mechanical properties.

Gd

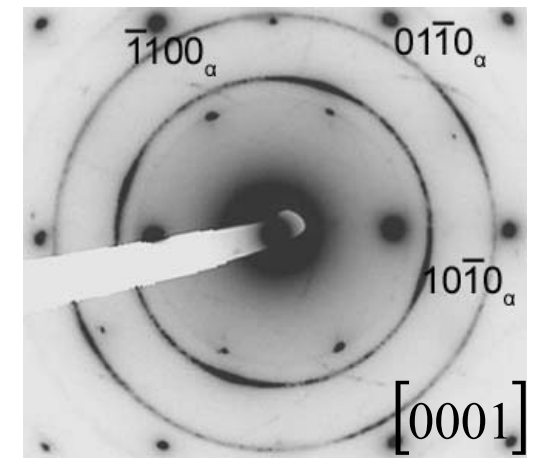
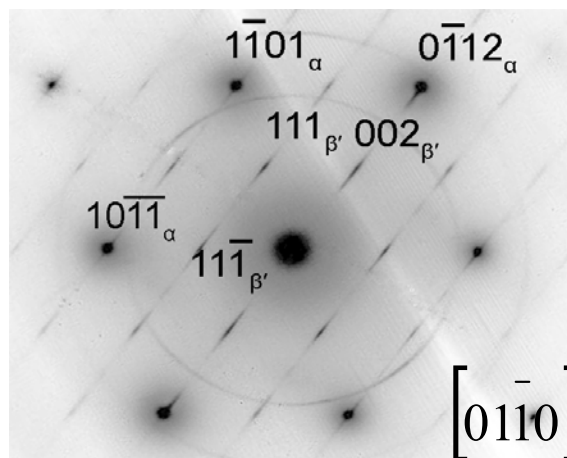
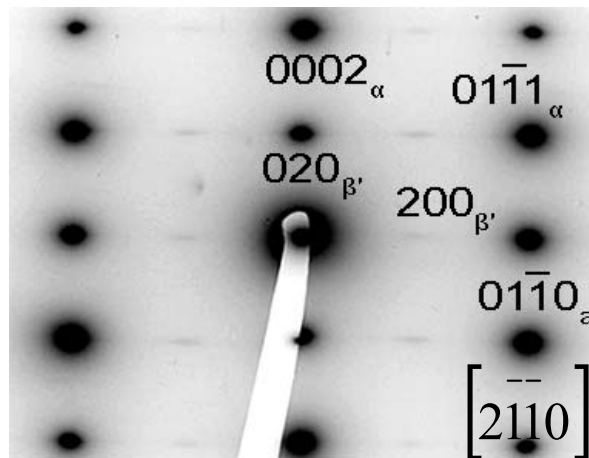
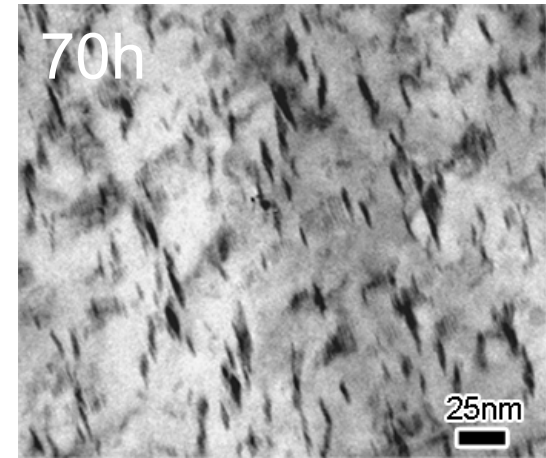
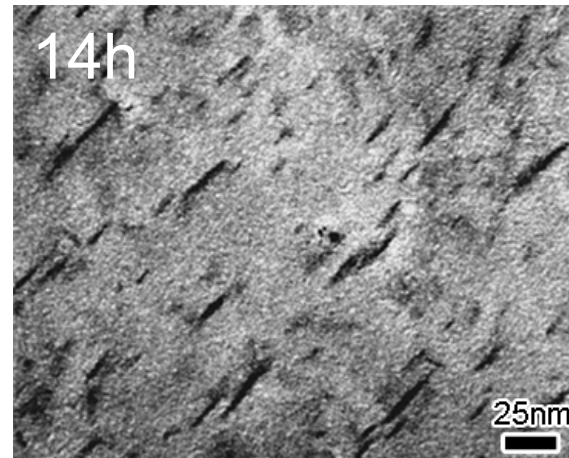
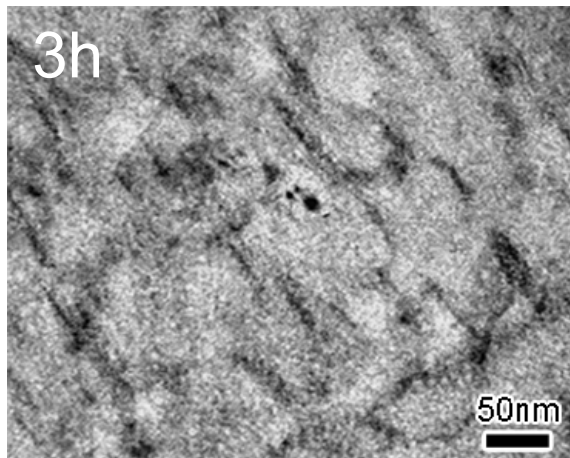
- ❑ Improved mechanical properties
- ❑ Common alloy, >10 wt%
- ❑ This work, 0.6 wt% as a micro-alloy element

Nano precipitates

- ❑ Microstructure evolution (TEM)
- ❑ Chemical compositions (Atom Probe Tomography)



TEM observation



■ Lathe-like precipitates with fcc structure.

■ Orientation relationship:

$$[001]_{\beta'} \parallel [2\bar{1}\bar{1}0]_{\alpha\text{-Mg}}, \quad (200)_{\beta'} \parallel (01\bar{1}0)_{\alpha\text{-Mg}}$$

$$[\bar{1}10]_{\beta'} \parallel [01\bar{1}1]_{\alpha\text{-Mg}}, \quad (002)_{\beta'} \parallel (0\bar{1}12)_{\alpha\text{-Mg}}$$

Atom probe tomography



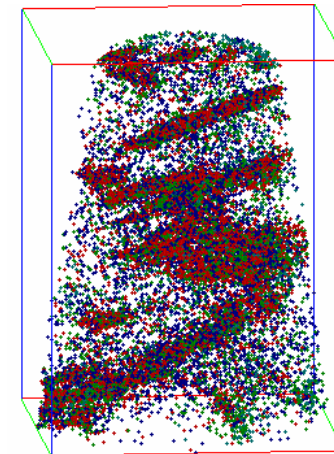
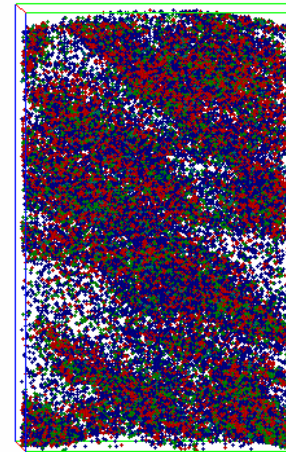
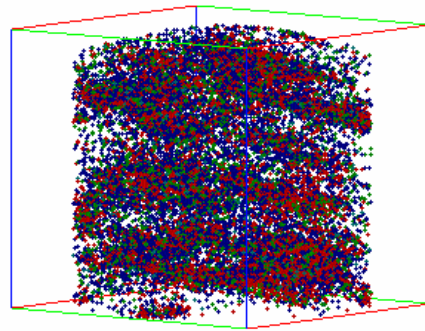
View direction
close to [1210]

3 h

14 h

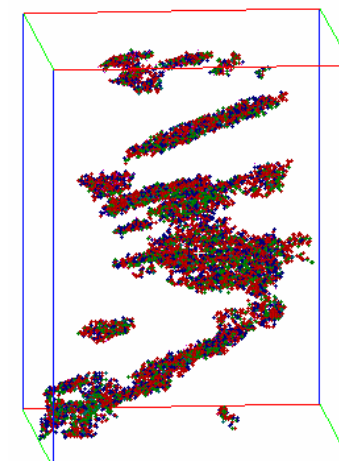
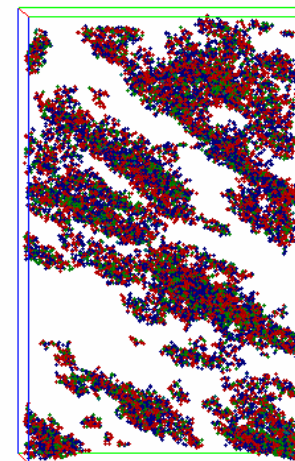
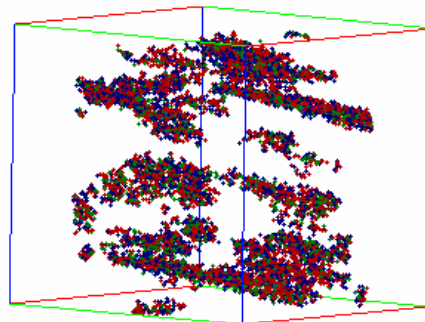
70 h

Combined
NdZnGd maps

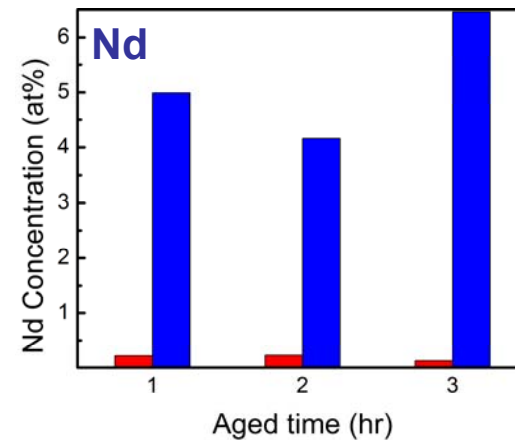
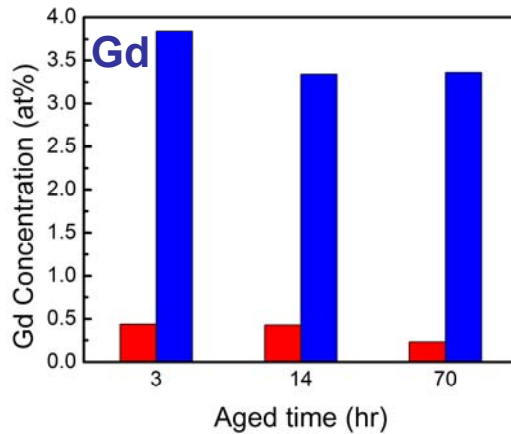


20 nm

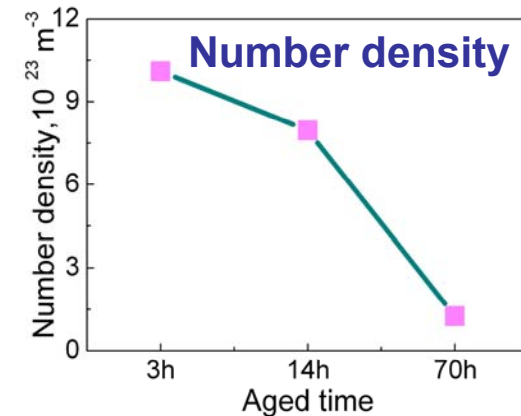
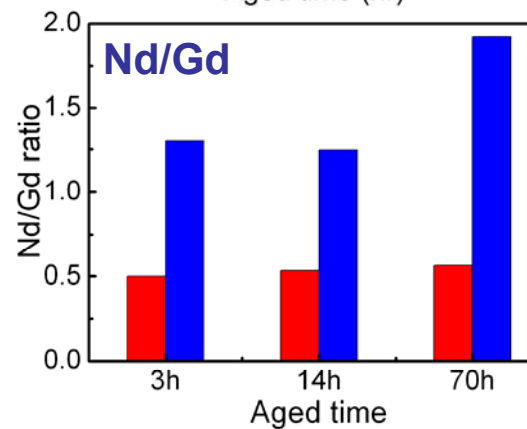
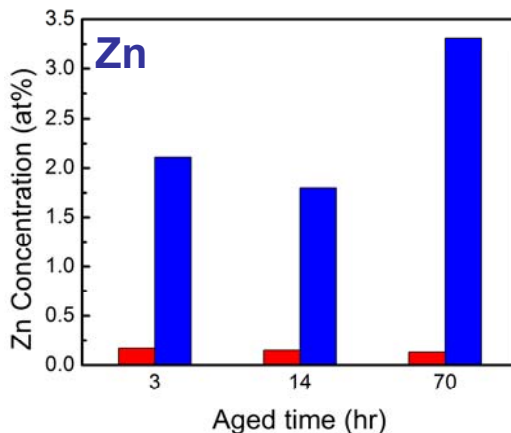
After
removing
matrix atoms



Atom probe data analysis



Matrix
Precipitates



- The precipitates are enriched with Nd, Gd and Zn with relative ratio of 4:3:2
- They are about 50nm long, 10nm wide, and 2.5nm in thickness. The relative ratio is about 20:4:1. Their elongated axis is often parallel to [0001] of Mg matrix.



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