

N. F. Hayazi, Y. C. Kang and S. L. I. Chan

School of Materials Science and Engineering, University of New South Wales, Sydney 2052 Australia

Ph: (02) 93854441 E-mail: [sli.chan@unsw.edu.au](mailto:sli.chan@unsw.edu.au)

## Introduction

Precipitation-hardenable aluminum alloys have a relative high specific strength, good fracture toughness, and excellent fatigue properties which are useful for aerospace applications.

These alloys can be produced by powder metallurgy (P/M) techniques but some investigations have indicated that fine reinforcements or intrinsic oxide inclusion particles have a strong influence on the precipitation kinetics of P/M aluminum alloys [1-2].

Thus, this poster is to present the microstructural study on the aging behaviour of an AA 2014 (4.61 wt% Cu, 0.89 wt% Si, 0.56 wt% Mg, 0.89 wt% Mn, and 0.03 wt% Fe) with two different oxide inclusion contents as produced by P/M techniques.

## Method

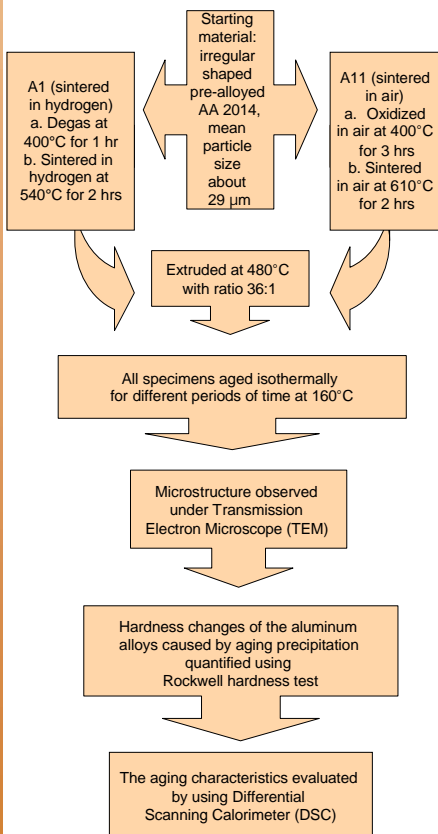


Figure 1: Experimental Procedures

## Notes

A1= 0.53 wt% oxygen contents  
A11= 1.37 wt% oxygen contents

## Results and Discussions

### 1. TEM Observations of Aging Behaviour of P/M AA 2014 with 2 Different Oxide Contents

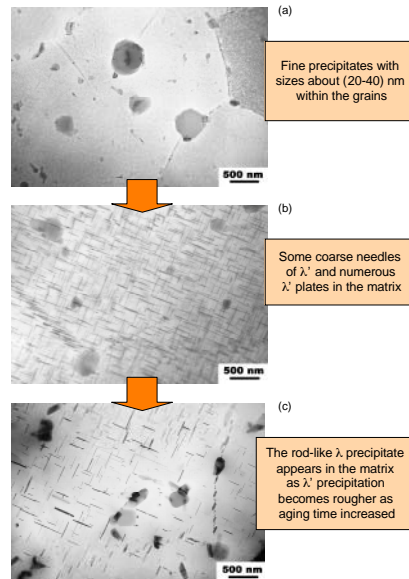


Figure 2: TEM micrograph of the P/M AA 2014 sintered in hydrogen consisting of 0.53 wt% oxygen contents (a) under-aging (b) peak-aging (c) over-aging

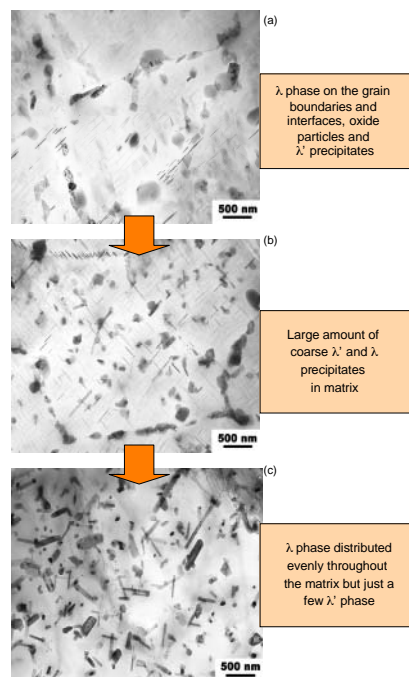


Figure 3: TEM micrograph of the P/M AA 2014 sintered in air consisting of 1.37 wt% oxygen contents (a) under-aging (b) peak-aging (c) over-aging

### 2. Rockwell Hardness Testing for Different Aging Time between P/M AA 2014 Sintered in Hydrogen and Air

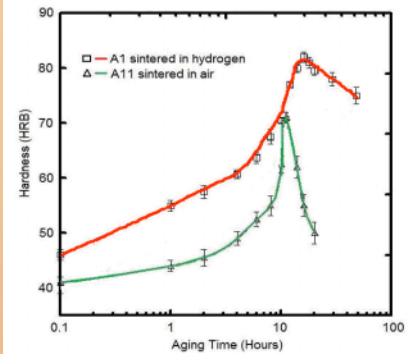


Figure 3: Hardness as a function of aging time at 160 °C for the P/M AA2014 sintered in hydrogen and air

### 3. Aging Characteristics Study using DSC

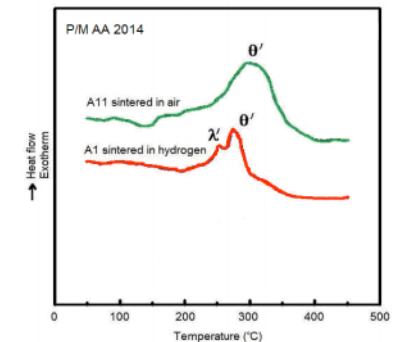


Figure 4: DSC curves showing the precipitation of P/M AA 2014 between sintered in hydrogen and air

## Conclusions

- The amount of oxide inclusion particles in the sample sintered in air was obviously more than that in the sample sintered in hydrogen.
- The degree of accelerated aging increased with the higher oxide inclusion contents. The acceleration could be associated with the accelerated  $\lambda'$  formation.
- The precipitated sequence of
  - sample sintered in hydrogen  
 $\lambda$  super-saturated solid solution  $\lambda$   $\lambda_1 + \text{GP Zone } \lambda$   $\lambda_2 + \lambda'$   
 $\lambda$   $\lambda_3 + \lambda'$   $\lambda_4 + \lambda + \lambda'$
  - sample sintered in air  
 $\lambda$  super-saturated solid solution  $\lambda$   $\lambda_1 + \text{GP Zone } \lambda$   $\lambda_2 + \lambda''$   
 $\lambda$   $\lambda_3 + \lambda'$   $\lambda_4 + \lambda$ ,  
 where  $\lambda_1$  to  $\lambda_4$  are aluminum with different Cu contents.

## References

- A. N. Abd El-Azim, Y. Shash, S. F. Mostafa and A. Younan, J. Mater. Process. Technol. 55 (1995) 140.
- H. L. Lee, W. H. Lu, S. L. I. Chan, Scripta Mater. 26 (1992) 1723