Submitted at the *130th Annual Meeting and Exhibition of the Minerals, Metals and Materials Society (TMS), New Orleans, February 11-15, 2001*

ON THE ORIGIN OF THE HIGH RESISTANCE TO COARSENING OF Ω PLATES IN Al-Cu-Mg-Ag ALLOYS

[1]C. R. Hutchinson, [2,3]X. Fan, [3]S. J. Pennycook and [1]G. J. Shiflet

[1]Department of Materials Science and Engineering, University of Virginia, Charlottesville, VA 22903, U.S.A.

[2]Department of Chemical and Materials Engineering, University of Kentucky, Lexington, KY 40506, U.S.A.

[3]Solid State Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, U.S.A.

Prepared by the

SOLID STATE DIVISION
OAK RIDGE NATIONAL LABORATORY
Managed by
UT-BATTELLE, LLC, for the
U.S. DEPARTMENT OF ENERGY
Under Contract DE-AC05-00OR22725

January 2001

On the Origin of the High Resistance to Coarsening of Ω Plates in Al-Cu-Mg-Ag Alloys

[1]C. R. Hutchinson, [2,3]X. Fan, [3]S. J. Pennycook and [1]G. J. Shiflet

1 Department of Materials Science and Engineering, University of Virginia, Charlottesville, VA 22903, U.S.A.
2 Department of Chemical and Materials Engineering, University of Kentucky, Lexington, KY 40506, U.S.A.
3 Solid State Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, U.S.A.

Abstract: Alloys based on the Al-Cu-Mg-Ag system have been reported to show excellent creep properties at temperatures up to 200 °C. This creep resistance has been attributed to the high resistance to coarsening of the dominant strengthening precipitate, Ω, which forms as platelets on the $\{111\}_\alpha$ planes of the matrix. In this investigation, atomic resolution Z-contrast microscopy has been used to examine the association of Ag and Mg with Ω plates for temperatures between 200 °C and 300 °C for times up to 1000h. Two atomic layers of Ag and Mg were found to be associated with the coherent broad faces of the plates at all times and temperatures observed and no segregation was found at the risers of thickening ledges or at the less coherent ends of the plates. Furthermore, within experimental error, no Ag or Mg was found within the Ω plates. Analysis of the thickening kinetics as a function of temperature suggests that the necessary Ag and Mg redistribution around a migrating thickening ledge is accomplished readily and it is concluded that the Ag and Mg segregation is not directly responsible for the high coarsening resistance of these plates. The high coarsening resistance is due to the increasing difficulty of ledge nucleation in what becomes an accumulating vacancy strain field normal to a thickening plate. Furthermore, it is concluded that the segregation of Ag and Mg to the coherent face of the Ω is *not* to help accommodate the large misfit (~ -9%) between Ω and the matrix as has been speculated in the literature. These experimental observations and conclusions will be discussed in this talk.

The authors greatly acknowledge the support of the Southeastern Universities Research Association (SURA) 1999 Summer Cooperative Research Program and the NSF under grant No. DMR9904034. The work at Oak Ridge National Laboratory was supported by the US Department of Energy under contract No. DE-AC05-00OR22725 with UT-Battelle, LLC.