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INVITED LECTURE

MICROSTRUCTURAL SIMULATION OF AGEING PRECIPITATION BASED ON THE DIFFUSION STUDY OF THE HCP_A3 PHASE IN Mg-Al-Sn ALLOYS

Students: Yuhui Zhang[1,2], Shuhong Liu[1], Yuling Liu[1]

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Abstract

Magnesium alloys are highly potential lightweight materials in structural material field. Thus, it is of great importance to design the high-strength Mg alloys in a highly efficient way. Computational simulations based on the microstructural evolution of precipitated phases during the aging precipitation process are expected to provide important guidance for the composition and heat treatment process design of new aging-strengthened magnesium alloys. Reliable thermodynamic and kinetic information is the basis for the microstructural simulation. For Mg-Al-Sn alloys, the thermodynamic research work has been well investigated, but the diffusion kinetic research is relatively less. In this work, 10 sets of diffusion couples were prepared, and diffusion couples were annealed at 723, 773, and 823 K to measure the diffusion behavior of different elements in the HCP_A3 phase. The composition-distance profiles were obtained by EPMA, and the variation of the interdiffusion coefficients of Al and Sn elements in the HCP_A3 phase with composition and temperature at different temperatures were calculated by the highly efficient software, i.e., CALTPP (CALculation of ThermoPhysical Properties). The atomic mobility parameters of the HCP_A3 phase were evaluated with the reported thermodynamic description of the Mg-Al-Sn system. The optimized atomic mobility parameters coupled with the thermodynamic information and key experimental data contributed to a more accurate prediction of the Mg-5.5Al-(2.5, 5)Sn(wt.%) alloy's microstructural evolution during aging. The present simulations could well predict the volume fraction, number density and particle size of the present experimental results and those determined by others.

Keywords: Magnesium alloys, Diffusivity, Atomic mobility, Microstructural simulation

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