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Effect of Prior Heat Treatment on the Microstructure Evolution and Creep Resistance of ZK60 Mg Alloy Under Tensile Creep Loading Along Normal Direction

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Abstract : Tensile creep tests were performed along the normal direction on the as-solutioned (AS) and as-aged (AA) samples of a commercial ZK60 alloy in this work. The results showed that the AA sample obtained a stronger 0.2% proof stress but a poorer creep resistance in comparison to the AS sample. It was revealed that the creep deformation in the AS sample was attributed to basal slip and twinning, while the creep behavior of the AA sample was controlled by basal slip, pyramidal <c+a> slip and twinning. Besides, the reasons for the poorer creep resistance of the AA sample were unveiled. Pyramidal dislocations towards various moving directions were found to accelerate the creep deformation, and basal dislocations kinking at twin boundaries were found to induce heavy stress concentration. Furthermore, massive dynamic precipitates, including beta 1 prime and beta 2 prime types, were formed in the AS sample during the creep exposure, contributing to the superior creep resistance. But in the AA sample, plentiful beta 1 prime and beta 2 prime phases generated during the prior peak-aging treatment dissolved into the matrix fast and only beta 1 prime re-precipitated during the creep process. With the decreased area fractions of precipitates, the age-hardening effect slacked off and failed to enhance the creep resistance.

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