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Effect of grain boundary characteristic on intergranular corrosion and mechanical properties of severely sheared Al-Zn-Mg-Cu alloy

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Abstract: Three kinds of heat treatment procedure, namely solid solution treatment (SST), homogenization heat treatment (HHT) and aging heat treatment (AHT), were adopted to control grain boundary characteristics of Al-Zn-Mg-Cu aluminum alloy after severe plastic deformation. And the experimental researches were employed to find the effect of grain boundary characteristic on intergranular corrosion of severely deformed aluminum alloy, including the optical microscope (OM), transmission electron microscope (TEM), X-ray diffraction (XRD) and electron back-scattered diffraction (EBSD). OM and EBSD observations show that heat treatment for severely sheared Al-Zn-Mg-Cu alloy can significantly increase the fraction of large angle grain boundaries and recrystallized grain boundaries. TEM observations agree well with the results of OM, EBSD and XRD, through the dislocations, the morphology and size of precipitated phase, and the grain boundary style. The results of microhardness and tensile tests maintain that AHT is the best way to improve both strength and plasticity. Intergranular corrosion observations show that sample after HHT has the optimum corrosion resistance while the sample after AHT possesses the worst performance. The influence mechanism of grain boundary characteristic on the corrosion resistance and mechanical properties is investigated in consideration of grain boundary type and precipitates in grain and grain boundaries.

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