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含Sc超高强Al-Zn-Mg-Cu-Zr合金的回归再时效处理制度

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摘要: 采用透射电镜分析、力学拉伸性能测试和电导率测试, 研究不同回归再时效(RRA)处理制度对含Sc超高强Al-Zn-Mg-Cu-Zr合金组织与性能的影响。结果表明: 采用120 °C, 24 h预时效+180 °C, 30 min回归处理+120 °C, 24 h终时效的RRA处理工艺, 可以使合金获得理想的力学性能和抗应力腐蚀性能; 与T6态相比, 该工艺获得的合金强度仅略微下降, 而电导率则大大提高; 含Sc超高强Al-Zn-Mg-Cu-Zr合金经RRA处理后, 晶内含大量均匀细小的 η' 相和少量的 η 平衡相, 合金晶界处的平衡相粗化明显, 呈现断续、孤立分布; 与T6态处理的合金相比, 无沉淀析出带变宽; 其晶内析出相与T6峰值时效态的类似, 晶界组织与双级过时效态的组织类似。

关键字: Al-Zn-Mg-Cu-Zr合金; Sc; 超高强; 再时效; 力学性能; 微观组织

Optimum retrogression and reaging heat treatment of super-high strength Al-Zn-Mg-Cu-Zr alloy containing Sc

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Abstract: The effects of retrogression and reaging (RRA) treatment on the microstructures and mechanical properties of super-high strength Al-Zn-Mg-Cu-Zr alloy containing Sc were studied by transmission electron microscopy, tensile and conductivity tests. The results show that perfect mechanical and stress corrosion resistance properties can be gained if the alloy is treated by the RRA heat treatment of 120 °C, 24 h pre-ageing, 180 °C, 30 min retrogression and 120 °C, 24 h re-ageing. Compared with the T6 sample, the strength of the alloy decreases slightly while the conductivity increases greatly. Treated by RRA, a great amount of fine and homogenized distributed precipitations η' and few equilibrium phases η are observed inside the grains, while the equilibrium phases on the grain boundaries coarsen obviously, distributing discontinuously and isolated. The precipitation free zones are broadened than that of the T6 sample. The microstructure

inside the grains is similar to that of the T6 sample while the microstructure of the grain boundary is similar to that of the duplex over-aged sample.

Key words: Al-Zn-Mg-Cu-Zr alloy; Sc; super-high strength; re-aging; mechanical properties; microstructure

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