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RRA处理对超高强铝合金微观组织
与性能的影响

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摘 要: 采用硬度、电导率测试、DSC热分析及TEM观察等手段,研究了回归再时效处理对一种新型低频电磁铸造超高强铝合金组织与性能的影响。研究发现:合金在120℃时效24h后具有较高的硬度和强度水平。合金适宜的回归再时效处理工艺为120℃、24h预时效,180、60min回归,之后120℃、24h再时效。在此条件下,合金的抗拉强度、屈服强度、延伸率和电导率(IACS)分别为721MPa、700MPa、8.1%和34.5%。TEM观察表明:回归再时效过程中合金性能的变化与其微观组织的演变密切相关;回归初期,GP区和 η' 相的回归导致合金硬度下降;随后, η' 和 η 相的析出使硬度重新上升至峰值;最后, η' 相转变成 η 、以及 η 相粗化引起硬度单调下降;再时效后析出的 η' 相提高了合金的强度、硬度和电导率。

关键词: RRA; 电磁铸造; 超高强度; 铝合金; 微观组织; 性能Effect of RRA on microstructure and properties of
new type ultra high strength aluminum alloyZENG Yu, YIN Zhi-min, ZHU Yuan-zhi,
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Abstract: The effect of Retrogression and re-ageing treatments on the microstructure and properties of a new type low frequency electromagnetic casting ultra-high-strength aluminum alloy were investigated using hardness and electric conductivity tests, DSC analysis and TEM observation. It is found that after ageing at 120°C for 24h, the studied alloy can gain high hardness and strength. After pre-ageing at 120°C for 24h, retrogression at 180°C for 60min, and then re-ageing at 120°C for 24h, the tensile strength, yield strength, elongation and electric conductivity(IACS) of the studied alloy are 721MPa, 700MPa, 8.1% and 34.5% respectively. The TEM observation shows that the property changes of the alloy during RRA are closely related to the microstructural evolution. In the early stage of retrogression, the re-dissolution of GP zone and η' leads to the decrease of hardness, while precipitation of η' and η makes hardness increase again to a peak value. Then, the transition of $\eta' \rightarrow \eta$ and coarsening of η lead to the decrease of hardness. Precipitation of η' after reageing increases the hardness, strength and electric conductivity of the studied alloy.

Key words: RRA; electromagnetic casting; ultra high strength; aluminum alloy; microstructure; property

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