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分级固溶对7A04铝合金组织与性能的影响

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摘要: 研究了分级固溶对7A04铝合金组织与性能的影响。结果表明: 7A04铝合金在470℃, 5min+485℃, 9min固溶和140℃, 6h+150℃, 1h时效后的 σ_b , $\sigma_{0.2}$ 和 δ_5 分别达到544.6MPa, 498.8MPa和11.1%。金相观察发现, 短时分级固溶(470℃, 5min+485℃, 3~9min)的晶粒尺寸较485℃单级固溶的细小。断口扫描电镜观察表明: 分级固溶获得了典型的韧窝型断口。X射线衍射分析结果表明: 470℃, 5min+485℃, 9min分级固溶后, 除少量 Al_2Cu 外, $MgZn_2$ 已完全溶解。能谱分析表明: 未溶相主要为富Fe和Cu的杂质相。由于470℃, 5min+485℃, 9min分级固溶的晶粒比485℃单级固溶的细小, 溶质过饱和度达到了500℃, 20min单级固溶的水平, 使得时效后的试样获得了最高的力学性能, 达到了常规固溶工艺的性能水平。

关键词: 高强铝合金; 分级固溶; 组织; 性能

Effects of progressive solution treatment on microstructure and mechanical properties of 7A04 aluminum alloy

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Abstract: The effects of progressive solution treatment on microstructure and mechanical properties of 7A04 aluminum alloy were investigated. Results indicate that after solutionized under condition of 470℃, 5min+485℃, 9min and subsequent aging process of 140℃, 6h+150℃, 1h, σ_b , $\sigma_{0.2}$ and δ_5 of 7A04 alloy reach 544.6MPa, 498.8MPa and 11.1% respectively. Metallography observation indicates that the grain size after short-time progressive solution treatment (470℃, 5min+485℃, 3-9min) is smaller than that after single-stage solution at 485℃. SEM observation indicates that the progressively solutionized sample in tension test behaves as typical dimpled fracture. X-ray diffraction analysis indicates that after progressive solution under the condition of 470℃, 5min+485℃, 9min, $MgZn_2$ as main strengthening phase is totally dissolved except a small amount of Al_2Cu . EDAX analysis indicates that the main undissolved phases are inclusions rich in Fe and Cu. Because the grain size of the sample progressively solutionized at 470℃, 5min+485℃, 9min is smaller than that of single-step solutionized at 485℃, the supersaturation degree of the progressively solutionized sample reaches that of the sample single-step solutionized at 500℃, 20min, and obtains the highest mechanical properties after subsequent aging, which is equal to those got by traditional solution process.

Key words: high strength aluminum alloy; progressive solution; microstructure; property

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