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Al-Li-Mg-Si合金时效行为及力学性能的研究

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AGING BEHAVIOR AND MECHANICAL PROPERTIES OF Al Li Mg Si ALLOYS

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摘要 研究了加入1.7% Li对Al－Mg－Si合金的时效析出行为及拉伸性能的影响，用Li－v 模型阐述了Li使Al－Mg－Si合金时效下行为发生转变的机制：Li与空位优先结合，抑制了位错环的形成及Si， Mg 原子的扩散和聚集，从而推迟和限制了G．P．区的形成，因此， Al－Li－Mg－Si合金中δ'相是主要强化相，Mg 2Si相只有经长时间的人工时效才能在基体中均匀析出。探讨了形变时效对Al－Li－Mg－Si合金组织和性能的影响，结果表明，时效前的预变形显著提高了Al－Li－Mg－Si合金的时效硬化速率和峰值强度，同样变形60% 的Al－Li－Mg－Si合金与不含Li的合金相比，具有相近的强度和延伸率，但前者具有较低的密度和较高的弹性模量，因此，Al－Li－Mg－Si合金表现出良好的应用前景。

关键词： Al-Li-Mg-Si合金 形变时效 力学性能 显微组织

Abstract： The effect of Li addition on the aging behavior and mechanical properties of an Al Mg Si alloy has been investigated. An Li v model has been suggested to explain the modifications caused by the Li addition. According to this mechanism, the preferential clustering of Li and vacancies inhibits the formation of dislocation loops and diffusion of Si and Mg atoms, so that the precipitation of G.P. zones is limited and delayed. Consequently, the ordered δ' phase becomes the predominant precipitate, and Mg 2Si phase can form only after aging for very long time. Furthermore, the effect of thermomechanical aging (TMA) on microstructure and properties of an Al Li Mg Si alloy has been carried out too. It has been found that TMA accelerates the aging reaction and peak strength of the Al Li Mg Si alloy greatly. The TMA improves the strength of Al Li Mg Si significantly, and does not destroy the elongation. Al Li Mg Si alloy has a bright applying prospect for it shows comparable strength and elongation with Al Mg Si alloys after TMA, but it possesses a lower density and higher modulus.

Keywords： A l-L i-M g-Si alloys TMA mechanical p ropert ies m icro st ructures

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