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原位生成 $TiB_2/Al-Si-Mg$ 复合材料的组织与性能

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摘要: 结合LSM法和MCR法原位反应生成 TiB_2 粒子增强 $Al-Si-Mg$ 复合材料。研究发现: 原位生成 TiB_2 粒子呈等轴状且尺寸 $<1\mu m$, 大都均匀分布在共晶组织中, 与共晶 Si 交织在一起, 在 $\alpha(Al)$ 中只有少量的 TiB_2 粒子; 原位 TiB_2 粒子可明显强化 $Al-Si-Mg$ 复合材料, 且随着 TiB_2 粒子数量的增加, 强化效果也随之提高, 而且延伸率也略有升高, 如6% $TiB_2/ZL104$ 复合材料室温拉伸强度可达296MPa, 延伸率为5.5%; 热处理(T_6)可将共晶 Si 由原先的连续棒状变为孤立的颗粒状, 大幅度提高材料抗拉强度, 使6% $TiB_2/ZL104$ 复合材料室温拉伸强度达386MPa, 而材料仍属于韧性材料。

关键字: $TiB_2/Al-Si-Mg$ 复合材料; 原位反应; 显微组织; 力学性能

Microstructures and mechanical properties of in-situ $TiB_2/Al-Si-Mg$ composites

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Abstract: In-situ TiB_2 particulate reinforced $Al-Si-Mg$ composites were fabricated by combining LSM method with MCR method. It is found that the shape of the in situ TiB_2 particles is equaxed, their size is less than $1\mu m$, most of them uniformly distribute in eutectic structures and are interlaced with eutectic Si , and there is a few of TiB_2 particles in $\alpha(Al)$. It is also found that TiB_2 particles can enhance the tensile strength of the composites, and with TiB_2 particles increasing the degree of enhancement is increased and the ductility is also raised slightly. For example, the tensile strength of 6% $TiB_2/ZL104$ composites is as high as 296MPa, and its ductility is 5.5%. Heat treatment can change the eutectic Si from continuous rod-like to isolated particle-like and increase the tensile strength of the composites considerably. The tensile strength of 6%

TiB₂/ZL104 composites after heat treatment can be enhanced to 386MPa, however the composites after heat treatment also belong to plastic material.

Key words: TiB₂/Al-Si-Mg composites; in-situ reaction; microstructure; mechanical properties

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