中国有色金属学报
中国有色金属学报(英文版)
中国科学技术协会 主管
中国有色金属学会 主办

论文摘要

中国有色金属学报
ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO
第17卷 第4期 (总第97期) 2007年4月

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文章编号：1004-0609(2007)04-0607-05

脉冲磁场下原位合成(A1203+A13Zr)p/Al复合材料的微观组织及力学性能

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摘 要：采用熔体反应法，以Al-ZrSiO$_4$为反应体系，在反应过程中施加脉冲磁场，原位合成Al$_3$Zr和Al$_2$O$_3$颗粒增强铝基复合材料。X射线衍射仪(XRD)、扫描电镜(SEM)和电子探针(EPMA)分析表明：脉冲磁场作用下，原位合成的颗粒细小，尺寸为1~3 μm，且弥散分布于基体中；随外加脉冲磁场强度的增大，反应生成的增强颗粒变得更加细小，分布更均匀。拉伸实验结果表明：脉冲磁场作用下原位合成复合材料的抗拉强度随着脉冲磁场强度的增大而升高，当磁场强度为0.05 T时，复合材料的抗拉强度比未施加脉冲磁场的复合材料提高28%；伸长率随磁场强度的增大略微下降。拉伸断口形貌分析表明：脉冲磁场作用下复合材料断口形貌中的韧窝和撕裂纹大大减少，但仍属于塑性断裂。

关键字： 铝基复合材料；脉冲磁场；原位合成；凝固组织；力学性能

Microstructure and mechanical properties of Al2O3+Al3Zr)p/Al composites in-situ synthesized under pulsed magnetic field

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Abstract: In-situ Al3Zr and Al2O3 particles reinforced aluminum matrix composites were synthesized by direct melt reaction method under pulsed magnetic field in Al-ZrSiO4 system. It is found by XRD, SEM and EPMA that the particles in-situ synthesized under pulsed magnetic field are fine and well distributed in the Al matrix, the size of Al3Zr and Al2O3 particles is in the range of 1?3 μm. With increasing pulsed magnetic intensity, the size and distribution of in-situ particles in the matrix become refiner and more homogenous. It is found that the ultimate tensile strength of (Al2O3+Al3Zr)p/Al composites is improved with increasing pulsed magnetic intensity, whereas the elongation of these composites goes down. Compared with the composites synthesized under zero pulsed magnetic field, the tensile strength of the composites synthesized is increased

by 28% when the pulsed magnetic intensity is 0.05 T. The fracture morphology indicates that the dimple and torn grain of the composites synthesized under pulsed magnetic field are less than those under zero magnetic field, but it still belongs to plastic fracture.

Key words: Al-based composites; pulsed magnetic field; in-situ synthesis; solidification microstructure; mechanical property