

论文

原位富Pb粒子/铝基金属玻璃基体复合材料的设计与制备

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摘要:

在Al-Pb二元难混溶合金的基础上添加其它的合金元素Ni, Y和Co, 优化设计了新的Al<sub>82.87</sub>Pb<sub>2.5</sub>Ni<sub>4.88</sub>Y<sub>7.8</sub>Co<sub>1.95</sub>多元难混溶合金. 开展了该多元难混溶合金的快速凝固实验, 对制备的薄带样品进行了结构表征、热稳定性分析以及显微组织形成的研究. 结果表明, 合金熔体在快速冷却过程中发生了液-液相分离, 生成富Al和富Pb两液相; 随后, 富Al基体液相发生玻璃转变, 形成铝基非晶合金基体, 而富Pb液相凝固结晶后以球形晶态粒子形式均匀分布于铝基非晶基体中. 研究表明, 利用难混溶合金液-液相变原理, 通过快速凝固技术可以设计和制备原位球晶粒子/非晶合金基复合材料.

关键词: 多元难混溶合金 液-液相变 快速凝固 非晶复合材料 原位球晶粒子

DESIGN AND PREPARATION OF IN SITU Pb-RICH PARTICLES/Al BASE METALLIC GLASS MATRIX COMPOSITE

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Abstract:

The typical Al-Pb immiscible alloy and the additional elements Ni, Y and Co were selected, and a new Al<sub>82.87</sub>Pb<sub>2.5</sub>Ni<sub>4.88</sub>Y<sub>7.8</sub>Co<sub>1.95</sub> multicomponent immiscible alloy has been designed. The ribbon samples of the multicomponent alloys were prepared by rapidly quenched method. The microstructure characterization, thermal stability and formation of composite microstructure have been investigated. The results indicate that the single-phase alloy melt separates into AlNiYCo-rich and Pb-rich liquids during cooling through the miscibility gap. Subsequently, the separated AlNiYCo-rich and Pb-rich liquids solidify into Al-based glassy matrix and crystalline Pb-rich phase, respectively. The crystalline Pb-rich phase in form of spheres is homogeneously embedded into the Al-based metallic glass matrix. Based on the mechanism of the liquid-liquid phase transformation in the miscibility gap of the multicomponent immiscible alloy, a new method has been developed to produce in situ crystalline spheres embedded into the metallic glass matrix by rapid solidification.

Keywords: multicomponent immiscible alloy liquid-liquid phase transformation rapid solidification metallic glass composite in situ crystalline sphere

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