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粉末冶金发泡时泡沫铝孔结构及泡壁的
微观组织演变

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摘 要: 研究了粉末冶金法制备泡沫铝时泡沫孔结构及胞壁微观组织变化的规律。泡沫铝发泡时经历微膨胀、显著膨胀和收缩等过程; 孔结构经历了形核和长大, 以及在毛细力和重力驱动下泡壁熔体的流动引起的合并粗化和孔隙率自上而下梯度减小等演化过程。加热时, 铝/硅颗粒边界处硅的扩散层首先熔化, 并沿着铝颗粒边界扩散, 最终使铝硅粉末复合物完全熔化而实现合金化。实验发现泡壁的凝固组织与典型的变质处理后的铸造铝硅合金的组织类似。

关键字: 泡沫铝; 粉末冶金; 孔结构; 微观组织

**Evolution of pore morphology and cell wall microstructure of
aluminum foam during powder metallurgical foaming**

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Abstract: Evolution of pore morphology and cell wall microstructure of aluminum foam during powder metallurgical foaming was studied. It was found that aluminum foam shows three stages during foaming, that is tiny expansion, remarkable expansion and shrinkage; and the pore morphology goes through three stages, that is nucleation and growth, merging and coarsening, and the porosity decreasing from the upper part of the foam to the lower part of the foam. The merging and porosity gradient of the pore structures were resulted from capillarity-driven and gravity-driven melt flow within the melt foam column. The silicon diffusing layer along the boundary of aluminum and silicon powders melts firstly during the heating, and then the melt diffuses along the boundary of the aluminum powders, resulting in the entire alloying between aluminum and silicon powders. The experiment shows that the solidified cell wall microstructures are similar to those of typical modified cast Al-Si alloys.

Key words: aluminum foam; powder metallurgy; pore morphology; microstructure

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