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不同准晶含量Mg-Zn-Gd-Y合金的高温热压缩变形行为

张 鉴¹, 张新平¹, 袁广银^{1, 2}, 张 松¹, 丁文江^{1, 2}(1. 上海交通大学 轻合金精密成型国家工程研究中心, 上海 200240;
2. 上海交通大学 金属基复合材料国家重点实验室, 上海 200240)

摘 要: 在应变速率为0.001 5~1.5 s⁻¹、温度为315 ℃条件下, 在Gleeble-3500热模拟机上对不同准晶含量(体积分数)Mg-Zn-Gd-Y合金的高温热压缩变形特性进行研究。研究变形过程中合金的真应力与应变关系, 通过选取合理模型描述了315 ℃时合金的流变应力与应变速率的关系, 并对不同准晶含量的合金在不同变形量下的微观组织进行观察。结果表明: 高应变速率下不同准晶含量的Mg-Zn-Gd-Y合金的真应力—应变曲线差异较大, 高准晶含量Mg-Zn-Gd-Y合金表现出较好的塑性变形能力; 应变速率的变化对高准晶含量Mg-Zn-Gd-Y合金的流变应力影响较大, 且Mg-Zn-Gd-Y合金变形后晶粒随应变速率的增大而减小; 在塑性变形过程中, 准晶可以促进Mg-Zn-Gd-Y合金的动态再结晶, 同时也有利于孪晶的生成。

关键字: Mg-Zn-Gd-Y合金; 准晶; 流变应力; 动态再结晶

Hot deformation behavior of Mg-Zn-Gd-Y base alloys with different contents of quasicrystal

ZHANG Jian¹, ZHANG Xin-ping¹, YUAN Guang-yin^{1, 2}, ZHANG Song¹, DING Wen-jiang^{1, 2}(1. National Engineering Research Center of Light Alloy Net Forming, Shanghai Jiao Tong University, Shanghai 200240, China;
2. State Key Laboratory of Metal Matrix Composites, Shanghai Jiao Tong University, Shanghai 200240, China)

Abstract: Hot compression tests of Mg-Zn-Gd-Y alloys with different volume fractions of quasicrystal were performed on Gleeble-3500 at strain rate range of 0.001 5~1.5 s⁻¹ and constant deformation temperature of 315 ℃. The relationship between the true stress and true strain of the Mg-Zn-Gd-Y base alloys was studied in the tests, and a proper constitutive equation was selected to describe the relation between the flow stress and strain rate. The microstructures of the investigated alloys were also studied in the hot-compression procedure. The results show that the true stress vs true strain curves vary with different volume fractions of quasicrystal at higher strain rate, the alloys with higher volume fraction of quasicrystal exhibit better formability. The strain rate change has a more significant impact on the flow stress of Mg-Zn-Gd-Y alloys with higher volume fraction of quasicrystal. The average grain sizes of the transformed Mg-Zn-Gd-Y alloys decrease with increasing strain rate. The dynamic recrystallization of Mg-Zn-Gd-Y alloys can be promoted by quasicrystal during deformation. At the same time, the quasicrystal also favors the formation of deformation twins.

Key words: Mg-Zn-Gd-Y alloys; quasicrystal; flow stress; dynamic recrystallization

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地 址: 湖南省长沙市岳麓山中南大学内 邮编: 410083

电 话: 0731-8876765, 8877197, 8830410 传真: 0731-8877197

电子邮箱: f-ysxb@mail.csu.edu.cn