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论文

准晶增强的Mg-Zn-Al-(Y)合金热压缩变形行为

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摘要： 通过常规金属型铸造工艺制备准晶相增强的Mg-8Zn-4Al(ZA84)和Mg-8Zn-4Al-0.5Y(ZAY8405)合金, 采用Gleeble-1500热模拟试验机在温度230 ℃和应变速率0.0015-1.5 s^{-1}的条件下, 对准晶增强的Mg-Zn-Al-(Y)合金的热压缩变形行为进行了研究. 结果表明: ZA84和ZAY8405合金铸态组织主要由二十面体准晶和α-Mg所组成, Y的加入可进一步细化凝固过程中形成的准晶相;Mg-Zn-Al-(Y)合金热变形过程中合金发生典型的动态再结晶,流变应力随应变速率增大而增大, 并可通过幂指数模型进行描述,应变速率变化对ZAY8405合金流变应力的影响更大; 热变形过程中,准晶可促进Mg-Zn-Al-(Y)合金的动态再结晶, ZAY8405合金中弥散分布的细小准晶以及Y的加入更有利于孪生和动态再结晶的发生.

关键词： Mg-Zn-Al-(Y)合金 二十面体准晶 热压缩变形 动态再结晶

HOT COMPRESSION DEFORMATION BEHAVIOR OF Mg－Zn－Al－(Y) ALLOYS REINFORCED WITH QUASICRYSTAL

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Abstract: Quasicrystal phase offers a good combination of strength and ductility due to the strong interface between the quasicrystal phase and the Mg－matrix. Hot compression tests of Mg－Zn－Al－(Y) based alloys reinforced with quasicrystal were performed on Gleeble－1500 thermal simulation machine at a constant deformation temperature of 230℃ and strain rates ranged from 0.0015 s^{-1} to 1.5 s^{-1}. Microstructure evolution of hot－compressed Mg－Zn－Al－(Y) alloys and the relationship between flow stress and strain rate were studied. XRD and SAED results show that the microstructures of as－cast Mg－8Zn－4Al (ZA84) andMg－8Zn－4Al－0.5Y (ZAY8405) are composed of icosahedral quasicrystal phase and α-Mg matrix. The quasicrystals in ZA84 and ZAY8405 alloys have a stoichiometric composition of Mg38Zn43Al19 and Mg51Zn30Al19 respectively. Dynamic recrystalization (DRX) take place during hot compression and the flow stress increases with increase of strain rate at constant compression temperature, which can be represented by the Power Exponential Equation. Deformation twinning and dynamic recrystalization are easier to take place in ZAY8405 alloys due to the refined and dispersed quasicrystal phase with Y addition.

Keywords: Mg－Zn－Al－(Y) alloy icosahedral quasicrystal hot compression deformation dynamic recrystalization

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