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Al-17.5Si-4Cu-0.5Mg合金热变形行为及其加工图

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Hot Deformation Behavior and Processing Maps of Al-17.5Si-4Cu-0.5Mg Alloys

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摘要
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摘要 采用Gleebe-1500D热压缩模拟试验机在变形温度350~500℃、应变速率0.001~5s^{-1}的条件下对Al-17.5Si-4Cu-0.5Mg合金进行热压缩实验,研究该合金在热塑性变形下的流变应力行为及其热加工特性,研究结果表明:Al-17.5Si-4Cu-0.5Mg合金为正应变速率敏感材料,该合金可用Znenr-Hollomon参数双曲正弦形式来描述高温塑性变形时的流变应力行为;合金平均热变形激活能Q为308.61kJ/mol.基于动态材料模型(DMM)建立了Al-17.5Si-4Cu-0.5Mg合金的热加工图,并结合热加工图和显微组织分析获得了该合金较优的热变形工艺参数:变形温度为400~470℃,应变速率为0.1s^{-1}.

关键词 : Al-Si-Cu-Mg合金, 热压缩变形, 流变应力, 加工图

Abstract: Hot compression tests of Al-17.5Si-4Cu-0.5Mg alloy were carried out at 350-500℃ and strain rates of 0.001-5s^{-1} on a hot-simulation machine Gleeble-1500D to study the hot deformation behavior and hot working property. Results show that the Al-17.5Si-4Cu-0.5Mg alloy is a positive strain rate sensitive material; the flow stress of this alloy can be described by the hyperbolic sine equation during high temperature deformation; the average thermal deformation activation energy *Q* is calculated to be 308.61kJ/mol. The processing maps were calculated on the basis of the dynamic materials model (DMM). The optimum processing parameters are determined by combining processing maps and microstructure evolution analysis. The deformation temperature are in the range from 400℃ to 470℃ and the strain rate is around 0.1s^{-1}.

Key words : Al-Si-Cu-Mg alloy hot compression deformation flow stress processing maps

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