

论文

Inconel 718合金方坯粗轧加热过程晶粒长大模型

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摘要:

以Inconel 718合金锻坯为研究对象, 在1173-1423 K的温度范围内, 研究了加热温度和时间对Inconel 718合金锻坯晶粒尺寸变化的影响, 推导并验证了具有普适意义的适合Inconel 718合金锻坯粗轧加热过程的晶粒长大模型. 研究表明: 随加热时间的延长, 在1173 K加热时, 晶粒尺寸变化不显著; 1173-1323 K加热时, 晶粒尺寸呈线性长大; 高于1323 K加热时, 晶粒尺寸呈抛物线性长大. 所建立的Inconel 718合金的晶粒长大模型适用于等温条件和非等温条件下晶粒尺寸演变的计算.

关键词: Inconel 718合金 晶粒长大模型 粗轧加热 等温条件 非等温条件

GRAIN GROWTH MODEL OF INCONEL 718 ALLOY FORGED SLAB IN REHEATING PROCESS PRIOR TO ROUGH ROLLING

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Abstract:

The Inconel 718 superalloy is extensively used to manufacture critical parts in aeronautical, astronautical, oil and chemical industries due to its excellent mechanical, physical and anti-corrosion behavior. Usually, these parts are shaped by hot forging or rolling in open-train mills. Recently, the tandem hot rolling has been applied to form superalloy bar products. In some cases, it can replace the traditional rolling, since it has higher productivity and product quality. In order to obtain the most favorable microstructure and the best mechanical properties of Inconel 718 alloy in tandem hot rolling, it is necessary to control its microstructural evolution in every step of the whole rolling process. With the aid of computer modeling, it is possible to make such a controlling process possible. As the first step in tandem hot rolling, reheating process of a forged slab prior to rough rolling plays a predominant role in predicting the grain size change or even the microstructural evolution. Thus, in this study, an Inconel 718 alloy forged slab was used as the experimental material and the effects of reheating temperature and holding time on its grain growth were investigated. A universal model was developed and verified for the grain growth of Inconel 718 alloy forged slab in reheating process prior to rough rolling. With the increase of holding time, the grain size shows no remarkable change up to 1173 K. The grain growth presents a linear trend in the range from 1173 to 1323 K. A parabolic trend of gain growth can be observed when reheating temperature is higher than 1323 K. The established grain growth model of Inconel 718 alloy would be suitable to calculate the grain size evolution under the both isothermal and non-isothermal reheating conditions. This could also provide a basis in formulating the technological parameters for tandem hot rolling of Inconel 718 superalloy.

Keywords: Inconel 718 alloy grain growth model reheating prior to rough rolling isothermal condition non-isothermal condition

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