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DZ68镍基高温合金的凝固偏析

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摘要: 利用硅-碳管炉制备凝固样品, 采用金相显微镜观察DZ68合金的凝固过程, 利用电子探针测定DZ68合金凝固过程中的元素含量, 研究DZ68合金的凝固过程及合金元素、杂质元素的偏析行为。结果表明: DZ68合金的凝固过程主要在1 370~1 310 °C内完成, 合金的终凝温度介于1 180~1 200 °C之间; DZ68合金中主元素W、Re、Ta、Al的偏析系数经测定分别为2.2、4.5、0.58和0.8, 其中W和Re为强烈负偏析元素, Ta是强烈正偏析元素; 有害杂质元素S、P、B和Si在枝晶间发生严重偏聚。热力学分析表明, 这些偏聚的杂质元素在枝晶间可能形成Ni₃P、Ni₃S₂和M₃B₂等低熔点化合物, 从理论上解释了DZ68合金终凝温度降低的原因。

关键字: DZ68; 高温合金; 凝固行为; 偏析

Solidification and segregation of DZ68 nickel-base superalloy

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Abstract: The samples of solidification were produced by the silicon-carbon tube. The whole solidification of DZ68 alloy was observed by optical microscopy (OM). The content of element of DZ68 alloy during of solidification was measured by electronic probe micro analysis(EPMA). The solidification behavior and segregation of elements in the DZ68 alloy were studied. The results show that the solidification of DZ68 alloy mainly completes between 1 370 and 1 310 °C, and the final set temperature is confirmed between 1 180 and 1 200 °C. The segregation coefficients of W, Re, Ta and Al in DZ68 alloy are obtained as 2.2, 4.5, 0.58 and 0.8, respectively. The segregation coefficients of different elements show that W and Re are strong negative segregation elements and Ta is strong positive segregation element. The impurity elements of S, P, B and Si are severely clustered in the interdendritic area. The thermodynamical analysis shows that these elements are possible to

form low melting compounds such as Ni_3P , Ni_3S_2 and M_3B_2 in the interdendritic area, which explains the reason why the final setting temperature of DZ68 alloy decreases.

Key words: DZ68; superalloy; solidification; segregation

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