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研究论文

18Cr10NiNb耐热钢析出相的热力学计算和平衡相分析

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摘要: 将18Cr10NiNb耐热钢在650℃进行10,000h的时效试验,用扫描电镜和透射电镜分析了18Cr10NiNb奥氏体耐热钢的组织, 通过热力学计算研究了500--1400℃碳、铌和氮含量的变化对平衡析出相的影响。结果表明: 在18Cr10NiNb钢的时效过程中在晶内析出了富Nb的MX相,在晶界析出了富Cr的M23C6相。根据热力学计算, 其平衡析出相为MX, M3C6和σ相。MX相和M23C6型碳化物的最高溶解温度分别约为1340℃和840℃。MX相的数量随C和Nb含量的提高而增加。σ相的数量随着C含量的提高而减少。添加0.2%的N元素后, MX相为含有N、Nb、Cr和少量C的复杂碳氮化物,且在其平衡组织中出现了Cr2N相。

关键词: 金属材料关 奥氏体耐热钢 18Cr10NiNb 析出相 热力学计算

Thermodynamic Calculation and Analysis on Precipitated Phases in 18Cr10NiNb Heat--resistant Steel

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Abstract: Long-term aging at 650℃ for the austenitic heat-resistant steel 18Cr10NiNb was conducted till 10,000 h. Effect of aging time on microstructure was investigated by SEM and TEM, and the effects of Nb, C, and N content on equilibrium phases from 500℃ to 1400℃ in 18Cr10NiNb steel have been calculated by using Thermo-Calc software. The results show that Nb-rich MX phase particles precipitate in the grains and Cr-rich M23C6 carbide mainly precipitates at the grain boundaries. The main equilibrium phases in18Cr10NiNb steel at 500--1400℃ are MX, M23C6 and σ. The solution temperatures of MX and M23C6 are about 1340℃ and 840℃, respectively. The amount of MX phase increases with increasing of C and Nb contents. The amount of σ phase decreases with increasing of C content. Adding 0.2%N in this the steel, MX phase contains N, Nb, Cr with a small amount of C, which is a complex carbon nitride and makes excellent strengthen effect. Cr2N phase appears as one of the equilibrium phases in the steel at the same time.

Keywords: metallic materials austenite heat resistant steel 18Cr10NiNb precipitation phases thermodynamic calculation

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