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论文

γ—TiAl合金拉伸形变的热激活参量

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摘要： 采用拉伸变形方式，在285—1273K范围内测定了具有近全片层组织的γ－TiAl合金（Ti-47Al-2Mn-2Nb-0.8TiB2）在屈服点的热激活参量：激活体积V,激活焓△H，激活自由焓△G和激活熵△S；据此推断控制γ－TiAl合金拉伸形变的微观位错机制. 发现在实验温度范围内，存在着三个温度区间，分别对应三个不同的可能热辅助位错运动机制：在低温温区（285—398K），位错运动阻力主要是Peierls－Nabarro阻力；在中温温区（523—873K），流变应力对温度和应变速率不敏感，但仍是一热激活过程；在高温温区（≥973K），控制塑性变形速率的微观机制是位错攀移此外，还发现激活熵△S随温度变化趋势与激活体积V相似，这在一定程度上也反映热辅助位错运动机制。

关键词： 金属间化合物 γ－TiAl合金 拉伸形变 热激活 位错机制

THERMAL ACTIVATION PARAMETERS OF TENSILE DEFORMATION OF GAMMA TITANIUM ALUMINIDE

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Abstract: Thermal activation volume V, activation enthalpy △H, activation free enthalpy △G and activation entropy △S of tensile deformation of a gamma titanium aluminide have been measured in a temperature range from low temperature(285 K) to 1273 K. The γ-TiAl has a chemical composition of Ti-47Al-2Mn-2Nb-0.8TiB2 and a microstructure of near lamellar, and the measurement was conducted at yield points. From the values and their temperature dependence of the measured activation parameters, as well as the temperature dependence of yield stress,the dislocation mechanisms of tensile deformation of the alloy have been speculated.It is found that there exist three temperature regions,which correspond to different possible thermal activation mechanisms of dislocation motion. In low temperature region(285-398K), the mechanism is mainly characterized by the overcoming of Peierls-Nabarro resistence. In intermediate temperature region(523-873K), the mechanism is a weak thermally activated process as the plastic flow is neither sensitive to temperature nor to the strain rate.In high temperature region(≥973 K), the rate controlling machanism is dislocation climbing.In addition,it is found that,activation entropy △S, whose variation with temperature is similar to that of activation volume V, also reflects the thermal activation mechanism of dislocation movement in some degree.

Keywords: intermetallics gamma titanium aluminide tensile deformation thermal activation dislocation mechanism

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