

论文

NiAl/TiC纳米材料机械合金化合成机理

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摘要: 四种元素粉末的混合物在室温下球磨、当球磨时间达到107min时,原位热分析监测到一个放热化学反应的发生分析表明大量的NiAl和TiC化合物反应生成其反应合成机理属于燃烧合成反应机制包含着两个独立的化学反应,即Ni+Al→NiAl, Ti+C→TiC. 燃烧反应后,还存在少量的元素粉末. 进一步球磨导致NiAl和TiC的逐渐生成. 终产物中TiC的晶粒尺寸约为NiAl晶粒尺寸的2.5倍,与传统观点相反,归结于一种新的变形机制.

关键词: 反应合成机理 机械合金化 纳米复合材料 金属间化合物

FORMATION MECHANISM OF NiAl/TiC NANOCOMPOSITE BY MECHANICAL ALLOYING

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Abstract: Ni, Al, Ti, and C powders mixed at a composition of Ni37Al37Ti37C13 were milled in a high-energy ball mill.Upon milling for 107 min,an abrupt reaction occurred, resulting in in situ formation of NiAl and TiC compounds.The formation mechanism is suggested to be two separated combustion reactions, i.e. Ni+Al→NiAl and Ti+C→TiC. The combustion reaction conducted incompletely and small amount of elemental powders still existed. Prolonged milling led to gradual formation of NiAl and TiC as well as the refinement of grain sizes. The final saturated grain size for TiC is 2.5 times as large as that for NiAl, though TiC has a much higher melting point compared with NiAl, this is attributed to a different deformation mechanism.

Keywords: formation mechanism mechanical alloying nanocomposite intermetallics

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