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Al含量对空心阴极等离子烧结Ti/Ni等原子比TiNiAl合金组织和力学性能的影响

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Effect of Al Content on Microstructure and Mechanical Properties of Hollow Cathode Plasma Sintering TiNiAl Alloys with Equal Ti/Ni Atom Ratio

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摘要

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摘要

采用空心阴极等离子烧结工艺制备了Ti/Ni等原子比的 $Ti_{50-x/2}Ni_{50-x/2}Al_x$ ($x=0,3,6,9$)合金,研究了Al含量对合金微观组织以及力学性能的影响。结果表明:未添加铝的合金微观组织主要由NiTi基体、强化相 Ti_2Ni 、 Ni_3Ti 及孔隙组成;随着Al含量的提高,合金中 Ti_2Ni (Al)数量不断增多,孔隙数量和孔径不断增加, Ni_3Ti (Al)数量不断减少,在 $Ti_{45.5}Ni_{45.5}Al_9$ 中还生成了少量 Ni_2TiAl 相;合金的抗弯强度随Al含量的提高而增加,并在Al含量为6%时达到最大值296.3 MPa;合金的硬度随铝含量的提高而增加, $Ti_{45.5}Ni_{45.5}Al_9$ 的硬度值为295.6 HV。

关键词: TiNiAl合金 Al含量 空心阴极等离子烧结 微观组织 力学性能

Abstract:

$Ti_{50-x/2}Ni_{50-x/2}Al_x$ ($x=0, 3, 6, 9$) intermetallic compounds with equal Ti/Ni atom ratio are fabricated through hollow cathode plasma sintering process, and the effect of Al content on the microstructure and mechanical properties of the alloys is investigated. The results show that the microstructure of an alloy without Al consists chiefly of the NiTi matrix, some strengthening phase Ti_2Ni , Ni_3Ti and some pores; with the addition and increase of the Al content, the amount of Ti_2Ni (Al) increases while that of Ni_3Ti (Al) decreases and a small amount of Ni_2TiAl is formed in $Ti_{45.5}Ni_{45.5}Al_9$, while the amount of pores and their sizes increase. The flexural strength of the alloys increases with increasing Al content and reaches the maximum of 296.3 MPa when Al content is 6%, and then it starts to decrease as Al content further increases. The hardness of the alloys increases with increasing Al content and the hardness of $Ti_{45.5}Ni_{45.5}Al_9$ reaches 295.6 HV.

Keywords: TiNiAl alloy Al content hollow cathode plasma sintering microstructure mechanical properties

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