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J. Shen, B. Chen, J. Umeda, K. Kondoh



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Microstructure and mechanical properties of CP-Ti fabricated via powder metallurgy with non-uniformly dispersed impurity solutes

J. Shen^{*}, B. Chen, J. Umeda, K. Kondoh,

Joining and Welding Research Institute, Osaka University, Japan

Abstract

Oxygen and nitrogen have been both known to have a strong hardening effect on Ti and its alloys, while also imposing a serious embrittlement effect. In the present work, Ti samples with non-uniformly dispersed oxygen and nitrogen solid solutions were produced using high purity Ti via powder metallurgy (PM) methods. The experimental results suggested that, when the solutes are non-uniformly distributed, the high solute content region can serve as strengthening particles as that in metal matrix composites. In light of this, we propose a design of novel structure in high oxygen/nitrogen Ti materials to achieve both improved strengths and ductility. The highlight of the structure is a design of strain gradient at the matrix-particle interface, which can mitigate the strain compatibility that commonly reported in general MMCs as the crack initiator. Instead of using ceramics as reinforcements, here we propose to use the matrix phase itself that hardened by high oxygen/nitrogen solutes as reinforcing particles.

Key words:

Titanium, Powder metallurgy, Strengthening mechanism, Ductility, Strain gradient

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