Kui Liu et al., J Mat. Sci. 2017, 5:6
DOI: 10.4172/2321-6212-C1-008

Melting, forging and phase transformation of a Mn containing β stablized γ-TiAl

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TiAlMn alloys are lightweight, low cost material with good mechanical property and proper oxidation resistance, always seemed as a promising material for automotive industrial application. This research was mainly focused on the VIM and conventional forging of a β-stabilized Ti-42Al-5Mn alloy, exploring the possibility that whether such cost-effective process can be applied to manufacturing advanced γ-TiAl. The oxygen-enrichment study and melting ingot analysis show that the contamination induced by strong interaction between molten liquid and crucible can be minimized when the thermodynamic stable CaO crucible and proper melting technique were adopted. The low oxygen content (<800 ppm) and chemically homogenized (main-element within ±0.2%) alloy can be successfully produced with IMR improved melting technique. With regards to conventional forging, based on hot deform mechanism and the phase transformation behavior studies, both the single step 10 kg VIM and 25 kg VIM+VAR ingots were successfully forged at a right hot deforming temperature with proper press descent speed. Finally, the microstructural evolution has been investigated for the forging bar by subjecting to solution and annealing two-step heat treatment. It was found that γ-phases cannot dissolve into β-phases when the solution temperature was below T_{solv}(1220°C). The undissolved γ-phases will be coarsening in the following 800°C annealing. Contrarily, when the solution temperature was above T_{solv} the γ-phases were dissolved completely and plenty of refined γ-platelets will precipitate from β-phases during air cooling. Thereafter, the γ-platelets will be stable with the above regime. In general, this work can provide a strong technical support for developing the cost-effective γ-TiAl alloys.

Biography

Kui Liu has received his PhD from the Institute of Metal Research (IMR), Chinese Academy of Sciences (CAS) in 1999. He is a Group Leader of the Materials for Special Engineering in the Division of Materials for Special Environment of IMR. He has published more than 40 papers and holds more than 25 patents. The main research interests of him are special melting high purity reactive materials, like Ni base, NiTi shape memory and TiAl alloys.

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