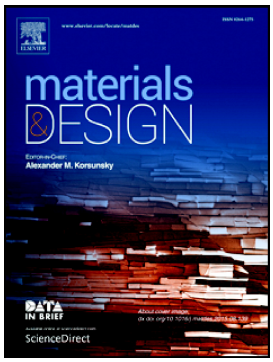

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Role of graphite on microstructural evolution and mechanical properties of ternary TiAl alloy prepared by arc melting method

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Abstract: Ternary Ti-30.7wt.%Al-*x*C alloys were prepared with different carbon content (*x* = 0.2, 0.4, 0.8, 1.2, 1.6, and 2.0 wt. %) by vacuum arc melting in order to improve the strength and ductility. Microstructure evolution and mechanical properties of alloys were experimentally and statistically studied, especially the carbide formation mechanism. The results show that Ti_2AlC phase appears when carbon content is more than 0.4%, and its volume fraction increases with increasing carbon content. Lamellar colony size, lamellar space and length-diameter of Ti_2AlC phase decrease with increasing carbon. Carbon has the certain solid solubility in matrix. Carbides form when addition of carbon content is over the solid solubility limit. Ti_2AlC acts as heterogeneous nucleation particles and carbon decreases the rate of lateral thickening of γ lamellae plates, which are the reasons for refining microstructure. High-melting-point TiC particles act as nucleation particles to form Ti_2AlC and refine the Ti_2AlC with more TiC content. Tensile strength increases 1.6 times at 750℃ with increasing carbon content. Tensile strength increases 1.5 times from 750℃ to 850℃ with 0.8% carbon and the maximum strain is 3.7%. Precipitation strengthening of Ti_2AlC particles and grain boundary strengthening are mainly mechanisms to improve mechanical properties.

Key Words: TiAl; Carbon; TiC particles; Ti_2AlC particles; Tensile properties

Nomenclature:

γ phase	TiAl phase
α_2 phase	Ti_3Al phase
δ phase	$TiAl_3$ phase
H phase	Ti_2AlC phase