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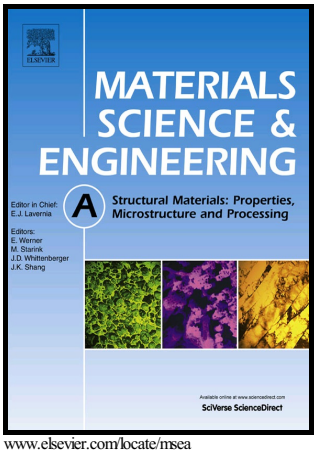

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In-situ TiB_2-NiAl composites synthesized by arc melting: chemical reaction, microstructure and mechanical strength

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Abstract: TiB_2 particles (5 vol.% and 10 vol.%) reinforced NiAl matrix composites were fabricated *in-situ* from Ti-B-Ni-Al system by arc melting. The reaction mechanism and mechanical properties of the composites were studied. When the reaction system was heated to 917 K, Ni and Al reacted with Ti to form the transient phase $AlNi_2Ti$, which continued to react with B to yield ultrafine TiB_2 particles acting as reinforcement agent. The apparent activation energy for these two reactions were calculated and found to be 497.99 kJ/mol and 2354.78 kJ/mol, respectively. The reinforcement agent exerted dispersion strengthening effect on the matrix. The room temperature compressive strength of the composites reinforced by 10 vol.% of TiB_2 particles was determined to be 538.3 MPa, representing a 35.2% increase over NiAl alloy. To further refine the grain size, the rare earth element cerium (2 wt% and 4 wt%) was introduced to the composites. The compressive strength of the composites containing 4 wt% Ce was determined to be 571.1 MPa, representing a 43.5% increase over NiAl alloy.

Keyword: NiAl matrix composites, Exothermic dispersion synthesis, Reaction mechanism, Rare earth element, Mechanical properties

1. Introduction