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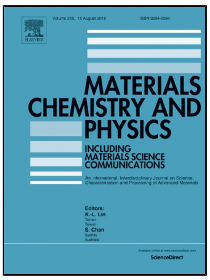

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Influence of C addition on solid-state reaction of Ti-Si-C system

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Abstract

The effect of C addition on synthesis behavior, microstructure, reaction mechanism and high-temperature oxidation resistance of Ti-Si system was investigated. The $Ti_5Si_3C_x$-TiC composite was synthesized by introducing the C into Ti-Si system and using mechanically activated self-propagating high-temperature synthesis (MASHS). The addition of one mole C into 5Ti+3Si reduced activation energy of reaction from 207.5 kJ/mol to 189 kJ/mol. The reaction in the Ti-Si-C system was initiated by the formation of TiC and followed by synthesis of an interstitial solid solution of $Ti_5Si_3C_x$, while reaction in Ti-Si was activated by solid-state diffusion of Si into Ti. The ignition temperature of the reaction was reduced from 1000 °C to 900 °C when the combustion temperature slightly increased as a result of the C addition into the system. The wave velocity of the reaction was also declined from 55 mm/s to 48 mm/s. The microstructural observations show that dissolution of the C in Ti_5Si_3 crystal structure restricted microcracks formation through coarse grains. Moreover, the oxidation resistance of titanium silicide was improved by the formation of the interstitial solid solution.

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