High-energy Ball Milling and Subsequent Heat Treatment of Ti-Cu-Si-B Powders

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Keyword: high-energy ball milling, phase transformation, heat treatment, titanium alloys.

Abstract:
Multicomponent alloys with metal matrix and based on the Ti Ti6Si2B phases are potentially attractive for structural applications. However, there is limited information in literature on effect of alloying in stability of the Ti6Si2B compound, which presents its single-phase region close to the Ti-22Si-11B alloy composition (at%). In this sense, this work discusses on effect of copper addition on the stability of the Ti6Si2B compound. Elemental powder mixtures were used to prepare the Ti-xCu-22Si-11B (x = 2 and 6 at.-%) alloys by high-energy ball milling and subsequent heat treatment (1100oC for 240 minutes). The as-milled Ti-Cu-Si-B powders and heat-treated samples were characterized by X-ray diffraction, scanning electron microscopy, and energy dispersive spectrometry. Similar behavior was noted during ball milling of Ti-Cu-Si-B powders, i.e., the Ti5Si3 phase was formed after milling for 180 minutes. The mechanically alloyed and heat treated Ti-2Cu-22Si-11B alloy presented a matrix of Ti6Si2B dissolving close to 2 at% Cu. Precipitates of Ti5Si3 and other unknown Cu- and Fe-rich phase were also identified in microstructures of these quaternary alloys, whose amounts were increased in the mechanically alloyed and heat treated Ti-6Cu-22Si-11B alloy.