

Nanocomposites and nanomaterials

The effect of TiB₂ nanoparticles on the structure of TiB₂-(Fe-13wt.%Mo) composite materials

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In order to investigate the effect of TiB₂ nanoparticles on the structure formation the TiB₂-(Fe-13%Mo) composite materials with the initial TiB₂ particles size of 500-700 nm was produced by sintering in a vacuum.

The heterogeneous structure of TiB₂-(Fe-13wt%Mo) composite material contains light grey matrix and distributed white and grey colored grains (Fig 1a). The microanalyses revealed that the metal matrix is formed by Fe-Fe₂B eutectic. The composition of white colored grains corresponds to the Mo₂FeB₂ phase. Small grey inclusions were identified as complex (Fe,Ti)B phase. Hereby the TiB₂ nanoparticles were not revealed in the structure of composite materials. However, at several locations TiB₂ phase was found to nucleate and grow on the (Fe,Ti)B grains, as shown in Fig. 1b.

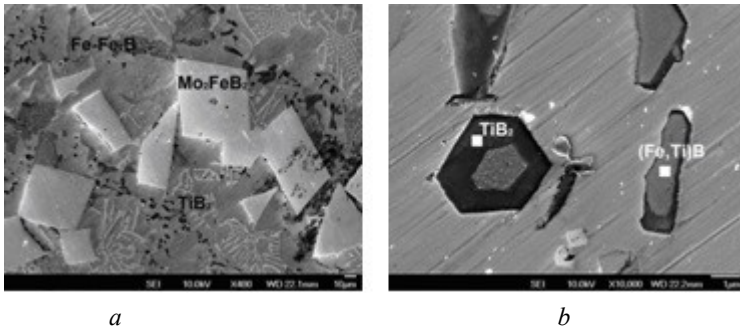


Fig. 1. Structure of TiB₂-(Fe-13%Mo) with TiB₂ nanoparticles:

a general view; *b* area of TiB₂ recrystallization

These results seem to indicate that TiB₂ nanoparticles dissolve completely into the liquid Fe-based alloy at high temperature that promotes formation of Mo₂FeB₂ and (Fe,Ti)B phases and Fe-Fe₂B eutectic. During cooling, due to the decrease in solubility of Ti and B, the TiB₂ crystals nucleate and grow from solutions in metallic melt.