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# Crystallisation of amorphous Fe – Ti – B alloys as a design pathway for nano-structured high modulus steels

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## Abstract

We systematically studied the transformation temperatures, type and growth kinetics of phases formed during annealing of Fe – 10.10 Ti – 3.86 B alloys, initially amorphous after rapid solidification. With increasing the temperature, four distinct crystallisation steps could be determined. At 530 °C  $\alpha$ -Fe (partly supersaturated with Ti) appeared, and at 600 °C small amounts of not identified phases formed in the amorphous matrix. The matrix fully crystallised to  $\alpha$ -Fe and contained (Fe,Ti)-B rich particles at 730 °C, which transformed to the equilibrium  $\text{TiB}_2$  phase at 755 °C. During annealing at 1000 °C both  $\alpha$ -Fe and  $\text{TiB}_2$  exhibited parabolic, apparently diffusion controlled growth at rates of about 2.333 and 0.466 nm s<sup>-1/2</sup>, respectively. Factors influencing the amorphisation as well as strategies for the fabrication of nano-structured high stiffness low density steels via crystallisation from an amorphous precursor state are outlined and discussed.

**Keywords:** metal matrix composites; metallic glass; steel; titanium diboride; stiffness; density

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