Crystallization kinetics of Fe-Cr-B amorphous alloys by high heating rate DTA

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Evidence shows that rapid annealing of metallic glasses leads to physical properties that are different from those stemming from isothermal or non-isothermal annealing with slow heating rate. Differential thermal analysis (DTA) with different heating rate up to 2500 K·min^{-1} was applied to amorphous alloy of composition $Fe_{85-x}Cr_xB_{15}$ (x = 0, 1, 5) in order to follow whole crystallization process. The results are compared with the usual –low – heating rate processes available by commercial DSC method.

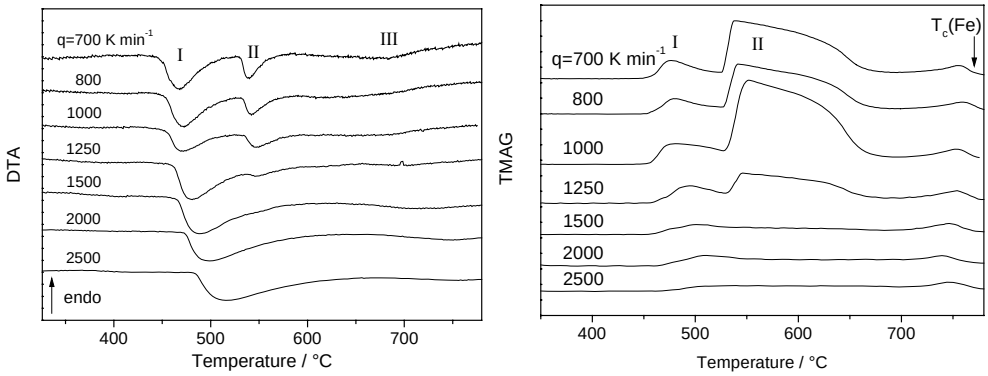

Fig. 1. Devitrification process of amorphous $Fe_{85}B_{15}$ alloy obtained with different heating rates: DTA curves from the crystallization region (left), and corresponding TMAG curves (right).

Simultaneously recorded high heating rate magnetic susceptibility complements the thermal measurements and reveal the interesting phenomenon of suppression of the decomposition of the residual amorphous phase when the heating rate exceed the values 1250 K·min^{-1}, 550 K·min^{-1} and 250 K·min^{-1} for x =0, 1 and 5, respectively. The high heating rate and the Cr addition both facilitate the formation of nanostructure, which is stable against further decomposition.

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