

Thermodynamic Analysis of Features of Phase Formation Processes in Amorphous Alloys of Fe-B System



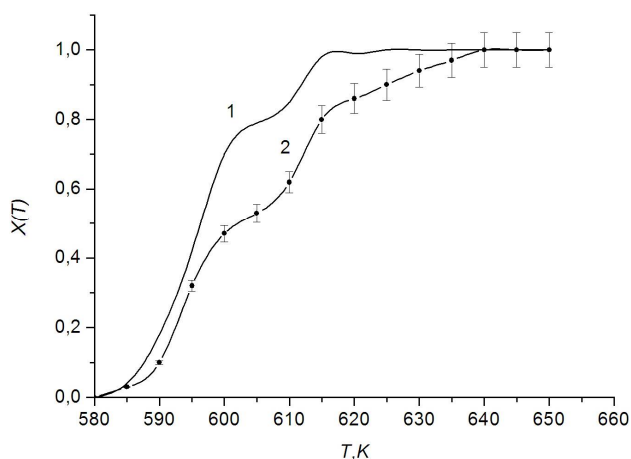
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The thermodynamical calculations of the kinetics of the process of crystallization of binary amorphous alloys of the Fe-B system under continuous slow heating and pulsed laser processing have been carried out within the framework of the modified theory of homogeneous crystallization for binary alloys, in which the work associated with concentration fluctuations is taken into account.

Experimental temperature dependence of the volume part of crystalline phases arising in amorphous alloy at continuous heating were determined using highly sensitive dilatometry.

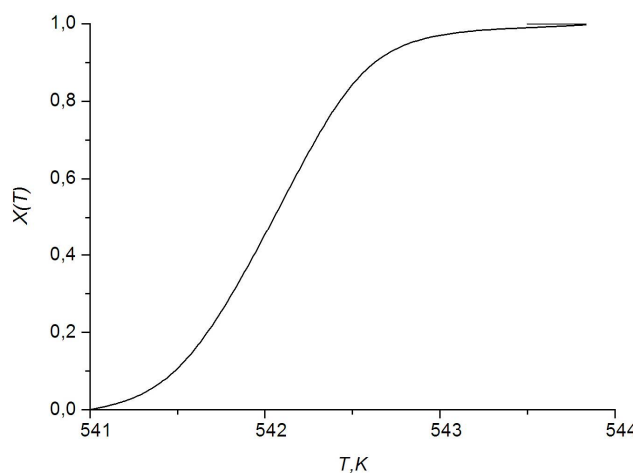
Temperature dependence of the volume part of crystalline phases, arising in $Fe_{75}B_{25}$ amorphous alloy at continuous heating at the rate of 0,17 K/s, (1 – calculation, 2 - experiment)



Under the action of an instantaneous laser pulse, during which the amorphous tape is heated by a laser beam to a given temperature within 10^{-6} seconds, explosive crystallization occurs for the $Fe_{75}B_{25}$ alloy in the temperature interval (543 - 546) K and for $Fe_{83}B_{17}$ alloy in the temperature range (585 - 587) K.

According to the calculation results, upon slow heating (0,17 K/s) crystallization of $Fe_{75}B_{25}$ and $Fe_{83}B_{17}$ alloys begins at temperatures of 590 K and 665 K, respectively. This is in good agreement with the results of the dilatometric experiment, which showed that the temperature of the beginning of intensive crystallization at such a heating rate is 600 K for the $Fe_{75}B_{25}$ alloy, and 670 K for the $Fe_{83}B_{17}$ alloy.

Temperature dependence of the volume part of crystalline phases, arising in $Fe_{75}B_{25}$ amorphous alloy an instantaneous laser pulse, heating time to predetermined temperature 10^{-6} seconds (calculation)



- The possibility of the phenomenon of explosive crystallization during pulsed laser annealing in binary amorphous alloys of the Fe-B system has been theoretically confirmed.
- It is shown that the phenomenon of explosive crystallization occurs at temperatures significantly lower than the temperature of the beginning of intensive crystallization in the process of isothermal annealing.