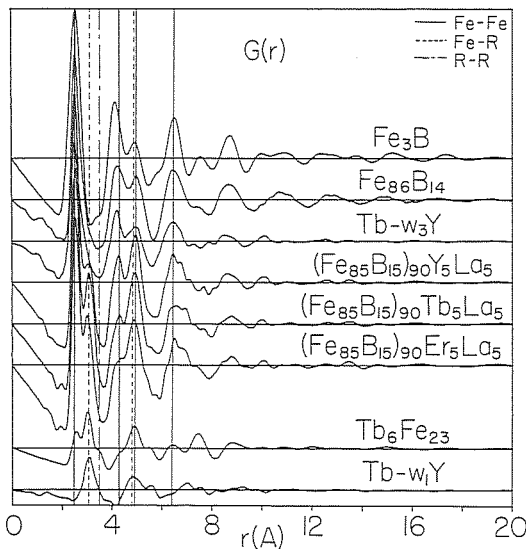


07.5-1 RDF ANALYSIS OF AMORPHOUS IRON-BORON-RARE EARTH ALLOYS. By Peter D'Antonio, Badri N. Das and Norman C. Koon, Naval Research Laboratory, Washington, D. C. 20375, U.S.A.

$(\text{Fe}_{0.85}\text{B}_{0.15})_{0.90}\text{R}_{0.05}\text{La}_{0.05}$ alloys, containing many of the rare-earth elements (R), have been produced in the amorphous state by melt quenching. As cast they have an intrinsic coercive force of 2 Oe, which increases rapidly to 9 KOe upon annealing at 650° C. The high coercive force of the crystallized alloy results from a mixture of R_6Fe_{23} and Fe_3B phases with a fine grained microstructure. We have examined three of these amorphous alloys (R=Y, Tb and Er) and amorphous $\text{Fe}_{86}\text{B}_{14}$, using x-ray diffraction with Ag radiation. Data were collected in transmission from three stacked 25 micron ribbons, and corrected for absorption. The diffraction data were analyzed with the RADILS radial distribution least-squares program to characterize both the short and long range structural ordering present. The experimental RDFs (shown in the figure) were compared with theoretical RDFs obtained from spherical regions of the Fe_3B structure (Fe_3P structure type) and the $\text{Tb}_6\text{Fe}_{23}$ structure. Because the scattering from boron is relatively weak, approximate partial Fe-Fe and Fe-R RDFs can be determined by weighted differences between the Tb and Y RDFs. The Tb-W₃Y difference curve essentially represents all Fe-R distances while the Tb-W₃Y curve is composed of essentially all Fe-Fe contributors. These differences reveal that the Fe topology in $\text{Fe}_{86}\text{B}_{14}$ and $(\text{Fe}_{0.85}\text{B}_{0.15})_{0.90}\text{R}_{0.05}\text{La}_{0.05}$ is very similar to that in Fe_3B (inner region of top three curves) and the short range Fe-R environment is similar to that in $\text{Tb}_6\text{Fe}_{23}$ (lower two curves), even in the amorphous state. Er has the smallest metallic radius in the series and a decrease in the Fe-Er distance can be seen in the figure. Incorporation of the different rare-earth elements is an isomorphous replacement, since the RDFs have essentially the same shape.



07.5-2 ON THE CRYSTALLIZATION OF FeP METALLIC GLASSES. By E. Hiltunen and M. Tamminen, Department of Physical Sciences, University of Turku, Vesilinnantie 5, 20500 Turku 50, Finland.

Crystallization kinetics and the sequence of crystallizing phases of FeP metallic glasses were studied during isothermal annealings. In energy dispersive x-ray diffraction (EDXD) measurements the diffractometer is kept at a constant geometry and the whole spectrum is measured simultaneously. When Anton Paar high temperature attachment is used the isothermal annealings can be carried out without moving the sample. This technique render it possible to follow and analyse the crystallization practically continuously. Because a measured spectrum is an average over a period used for the measurement, it is necessary to fit in the annealing time with the annealing temperature. The amorphous samples containing 18.9 at % phosphorus were prepared by electrodeposition.

During the heat treatments only the stable α -Fe and Fe_3P phases were formed. At temperatures higher than 590 K the crystallization of α -Fe started before the crystallization of Fe_3P phase, but at lower temperatures no time difference was noticed.

The crystallization kinetics of both observed phases were studied calculating the integrated intensities of appropriate diffraction lines growing during the annealing. Intensities were normalized using the total integrated intensities of the spectra and the final stage, heat treated at an elevated temperature, was chosen to be the reference stage.

The crystallization was noticed to obey a \sqrt{t} law and to be diffusion controlled. As figure 1. shows the average of the calculated Avrami exponents for both phases are between 1.1-1.2. At the very beginning of the crystallization the values of the Avrami exponents for α -Fe are a little bit higher (1.7 and 2.1) indicating nucleation. Also at the temperatures higher than 590 K, the exponents are slightly greater than at the lower temperatures.

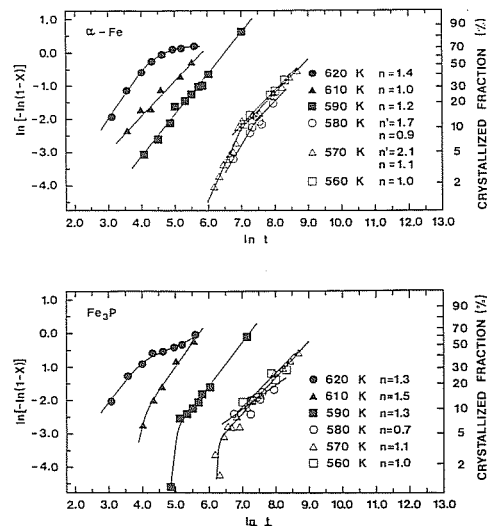


Figure 1. Crystallization kinetics of α -Fe and Fe_3P phases during isothermal annealings at different temperatures between 560 K and 620 K.

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