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# THE DTA ANALYSIS OF AMORPHOUS Co-Fe-Si-B alloys

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The compositional dependence of the DTA curves was analyzed for $Fe_xCo_{78-x}Si_9B_{13}$ metallic glasses. The crystallization temperature were determined. The results suggest that the thermal stability rises with increasing iron content.

Metallic glasses containing cobalt are the subject of intense investigations due to interesting thermal, mechanical and magnetic properties [1-3]. They are thermodynamically unstable and a basic parameter describing their thermal stability is the crystallization temperature. In this work we determined the crystallization temperature DTA analysis. The investigated samples were cobalt-iron metallic glasses in a wide range of compositions.

## Experimental

$Fe_xCo_{78-x}Si_9B_{13}$ metallic glass was prepared in the form of a ribbon about 2 cm wide, by rapid quenching, for x = 0, 4, 8, 18, 28, 38, 62, 66.

The material has been cut into pieces of about 1 square millimeter, then mixed with $Al_2O_3$ powder in the weight ratio 1:1 and milled in an electromagnetic mortar during 20 minutes.

Thermal analysis has been performed using a derivatograph Q-1500D apparatus is the temperature range from 20° to 1000°, and different heating rates Ø = 21, 10.8, 5.4, 2.8, 1.3 deg/min.

The analyzed material was placed in small open platinum crucibles. The samples were investigated under a flowing argon atmosphere.

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## Results and discussion

Figure 1 shows a series of measurements for the heating rate $\emptyset$ = 10.8 deg/min. The two thermal effects are clearly visible for every sample. In Table 1 temperatures of these two effects determined from approximation of the heating rate to zero are presented. The errors given in Table 1 were estimated from least square analysis.

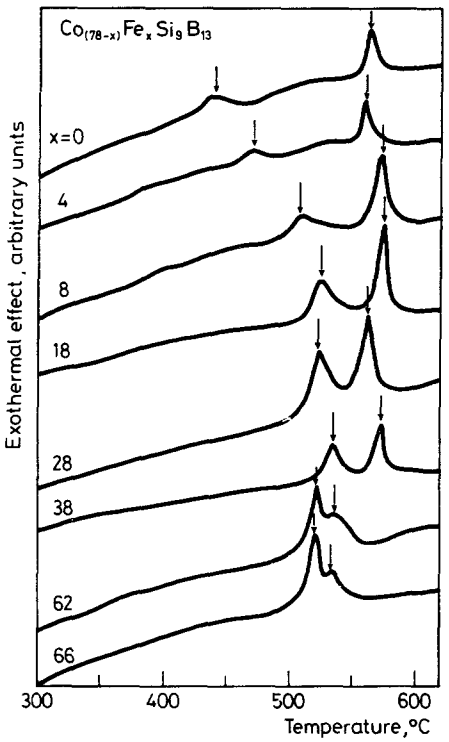


Fig. 1 The DTA curves for Co-Fe-Si-B amorphous alloys

The presence of two peaks on the DTA curve is shown for all values of x. In conformity with [2] the first peak involves the formation of dendrites, while the second is connected with a boride crystallization.

It is reasonable to assume that for the sample with zero iron content the temperature of both effects is much lower than in the other samples. The same result was reported in [3] for similar amorphous alloys $(Co_{1-x}Fe_x)_{75}Si_{10}B_{15}$. As it was shown in [4], an addition of iron to cobalt

reduces the covalent bond between the transition metals and metalloids and leads to more stable alloys. It is in agreement with the observed increase in the thermal stability (first effect) with increasing iron content in our samples.

**Table 1** Dependence of the temperature of the first and second thermal effect on the composition

| x | First effect | Second effect |
|---|---|---|
| 0 | 430±3 | 544±6 |
| 4 | 483 | 545±7 |
| 8 | 483±9 | 522±11 |
| 18 | 499±5 | 545±5 |
| 28 | 493±5 | 533±5 |
| 38 | 500±10 | 528±13 |
| 62 | 505±5 | 523±4 |
| 66 | 499±5 | 518±3 |

## References

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3 T. Komatsu, S. Sato and K. Matusita, Acta Met., 34 (1986) 1899.
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**Zusammenfassung** – An metallischen Gläsern FexCo78-xSi9B13 wurde die Abhängigkeit der DTA-Kurven von der Zusammenfassung untersucht. Den Ergebnissen nach steigt die thermische Stabilität mit wachsendem Eisengehalt.