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CONSTRUCTION OF THE MELTING DIAGRAMS OF SOME Mo-CONTAINING SYSTEMS AND THE METASTABLE MELTING DIAGRAM OF THE Cr-C SYSTEM USING DTA-TECHNIQUE UP TO 3000 K

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ABSTRACT

The DTA-apparatus which can be used up to 3000 K is developed. Melting diagrams of the systems Mo-(Nb, V, Cr), V-(Nb, Cr), Mo-V-(Nb, Cr) and a metastable melting diagram of the chromium-carbon system are constructed.

EXPERIMENTAL

A new DTA-apparatus provided with photocells as temperature sensitive elements enabled the DTA of alloys of refractory metals up to 3000 K. Fig.1 shows multiple-heating DTA-curves of a pure Mo in a HfO_2-crucible. The apparatus is patented in USA (N 4317360), France (N 8012795) and GFR (N 3021630).

RESULTS AND DISCUSSION

Using DTA method complete melting diagrams of the Mo-Nb, Mo-V, Mo-Cr (Fig. 2), V-Nb and V-Cr (Fig. 3) binary systems and those of the Mo-V-Nb (Fig. 4) and Mo-V-Cr (Fig. 5) ternary systems were constructed. 10 alloys for each binary system and 4 alloys for each ternary system were investigated. Mathematical models were constructed for solidus and liquidus surfaces of the diagrams. The melting diagrams for the binary systems Mo-Nb and V-Cr are significantly different from those known earlier: they feature no melting temperature minima. Liquidus surfaces (curves) for the most of the systems under study and the melting diagram of the Mo-V-Cr system have been determined for the first time.

Using DTA for the chromium-graphite powders mixtures endothermal effects have been observed below the stable equilibrium solidus temperature for a given composition which are due to melting of metastable eutectics. Fig. 6 shows DTA-heating-curves for the mixture of chromium and graphite (34 at.%C) powders. In addition to effects at 1830, 1860 and 2020 K which belong to the stable Cr-C-equilibrium diagram the first heating-curve (Fig. 6.1) featu-

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res some additional effects at 1680, 1725, 1785 and 1810 K which are believed to be due to metastable eutectics. The last heating-curve (Fig. 6.2) features only the effects of the stable equilibrium solidus (2010 K) and liquidus (2130 K). The obtained metastable melting diagram of the system Cr-C is shown in Fig. 7 (dashed line) together with a stable phase diagram (solid line) of the same system.

CONCLUSIONS

1. A new DTA-apparatus provided with photosensors has been developed, which can be used up to 3000 K.

2. Using DTA method complete melting diagrams of the systems Mo-(Nb, V, Cr), V-(Nb, Cr) and Mo-V-(Nb, Cr) were constructed.

3. Using DTA method the formation of the metastable melt has been revealed and the metastable melting diagram of the Cr-C system has been constructed.

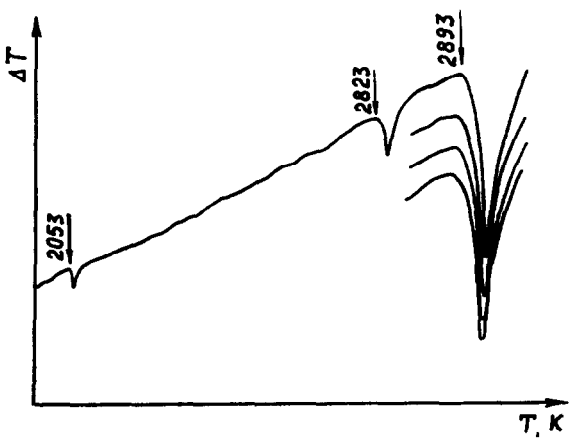

Fig.1. Effects at 2053 K and 2823 K: transformations in crucible material (HfO_2).

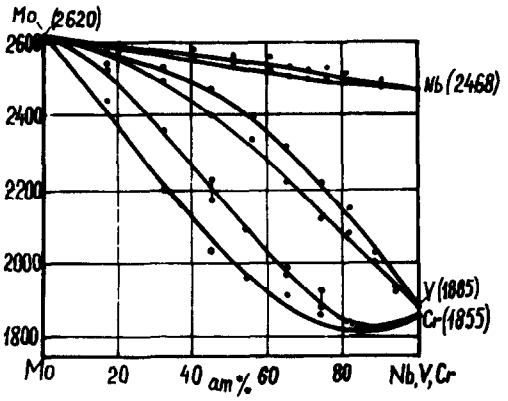

Fig. 2

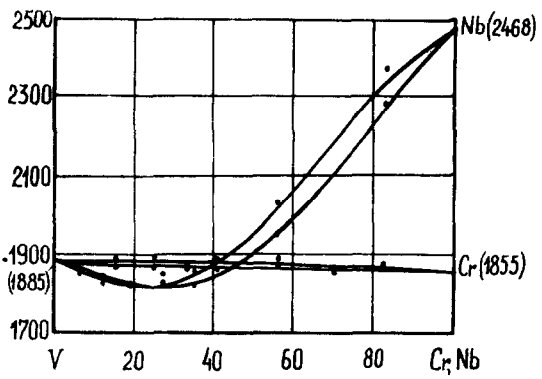

Fig. 3

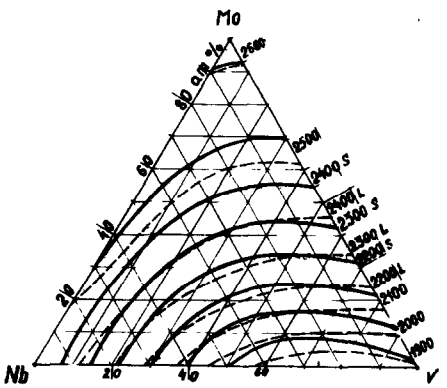

Fig. 4. Projections of isotherms of solidus (solid lines) and liquidus (dashed lines) surfaces.

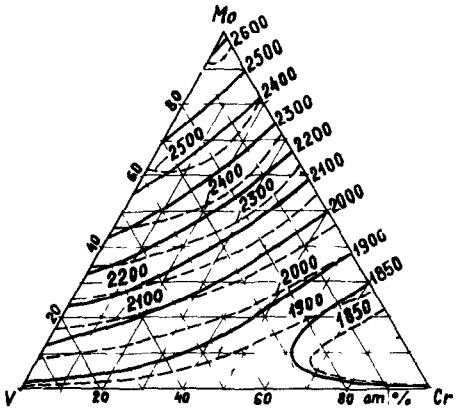

Fig. 5.
Designations see fig.4.

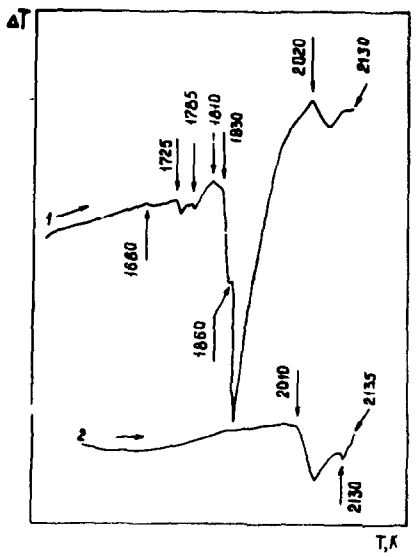

Fig. 6.

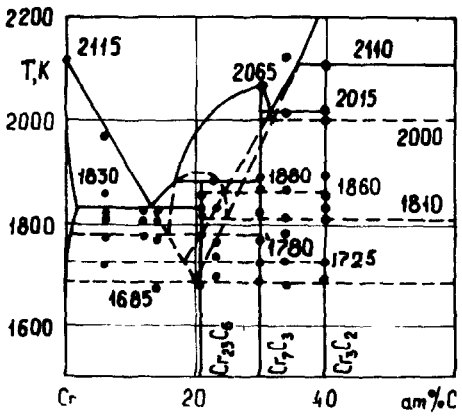

Fig. 7.