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STUDYING SALT SYSTEMS WITH "WEDGED - OUT" COMPOUNDS BY DTA METHOD

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ABSTRACT

A wide application of differential-thermal analysis in studying heterogeneous equilibriums in polycomponent systems made it possible to single out a number of diagrams of state, which reveal lack of the phase of the similarly melting compound in a completely crystallized alloy. It led to the conclusion that traditional means of triangulation of diagrams of compounds in polycomponent systems are restricted. The authors worked out general rules of differentiation of a system into components - phase unit blocks.

Physical-chemical analysis of polycomponent systems is a complexity of methods of planning an experiment, which allow to find out how properties of poly-phase compounds depend on the composition of a mixture. This complicated problem can only be solved if there are algorithms suggesting no ambiguous approach to the experimental material and optimizing therefore the investigation. In building diagrams of state "composition-melting temperature" of salt systems a most important stage is that of breaking-up the initial poly-dimensional complexes into simplexes. A simplex can be identified with a simplest geometric figure the peaks of which correspond to the initial components of a system or to the poles of similarly melting compounds with the eutectic star adequate to the figure [1]. But the DTA application in studying geterogeneous equilibriums L - S made it possible to single out a number of diagrams of state of three-component

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systems with double compounds with lack of mutual crystallization of three phases, including the corresponding compound. This can be substantiated by a three-component system of KF, KBr, K_2CO_3 (Fig. 1). The system was studied with the help of projection-thermographic method [2], according to which the most rational polythermal section is section A - B (Fig. 1), that crosses crystallization fields of K_2CO_3, K_3FCO_3 and KF. Fig. 2 shows the diagram of state built according to the results obtained by the DTA of 33 compounds. The peculiarity of this diagram is a curve of two-variant equilibriums amR. By lowering the temperature similar crystallization $L = K_2CO_{3s} + K_3FCO_{3s}$ turns into non-similar $L + K_3FCO_{3s} = K_2CO_{3s}$ on this curve. The border point "m" reveals the end of similar and the beginning of non-similar processes of crystallization. The dissolution of the double compound K_3FCO_3 is complete by the temperature of 530° by the phase reaction $L + K_3FCO_{3s} = KF_s + K_2CO_{3s}$. This temperature corresponds to the point of "wedging-out" R (Fig. 1). On the diagram of state of the polythermal section the non-similar process $L + K_3FCO_3 = KF_s + K_2CO_{3s}$ corresponds to the line $R' - R'''$ (Fig. 2).

The analysis of phase equilibriums in a system according to the DTA data showed that in no non-variant similar crystallization process takes part the phase of the compound K_3FCO_3. That is why by complete solidification of any initial composition of a system there are only three phases in an alloy: KF, KBr, K_2CO_3. This fact is substantiated by the roentgen-phase analysis data.

The studies proved that the diagram of compositions of three-component systems having a double compound of similar melting with a "wedged-out" crystallization field can't be triangulated by a secant line crossing the pole of the compound.

The authors suggested a general term - "phase unit block" (PUB) - instead of "simplex". PUB is a concentrated field of a system, its final products of crystallization being phases adequate to individual substances forming a block or to the solid solutions on their base [3]. In this case the geometric model of a PUB may be both a simplex in its traditional meaning (a triangle, a tetrahedron, e.t.c.).

According to the introduced concept the system under study is a phase unit block and cannot be differentiated.

The reason for introducing the concept "phase unit block" is substantiated by studying a great number of three-, four- and five-component systems with double compounds of similar and non-similar melting, also by solubility existing in solid state.

CONCLUSIONS

DTA application in studying equilibriums L - S made it possible to single out the main element of differentiation of a field of diagrams of compositions with a definite and constant complexity of crystallized phases - a phase unit block - as a generalized sign of a unit component of a system.

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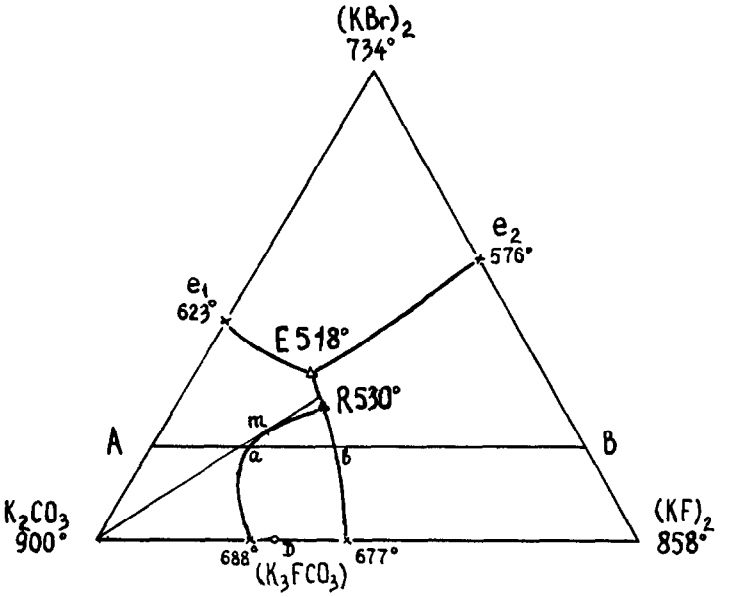
(KBr)2
734°
e2
576°
e1
623°
E 518°
R 530°
m
A
B
a
b
K2CO3
900°
(KF)2
858°
688°
D
677°
(K3FCO3)

Fig. 1.

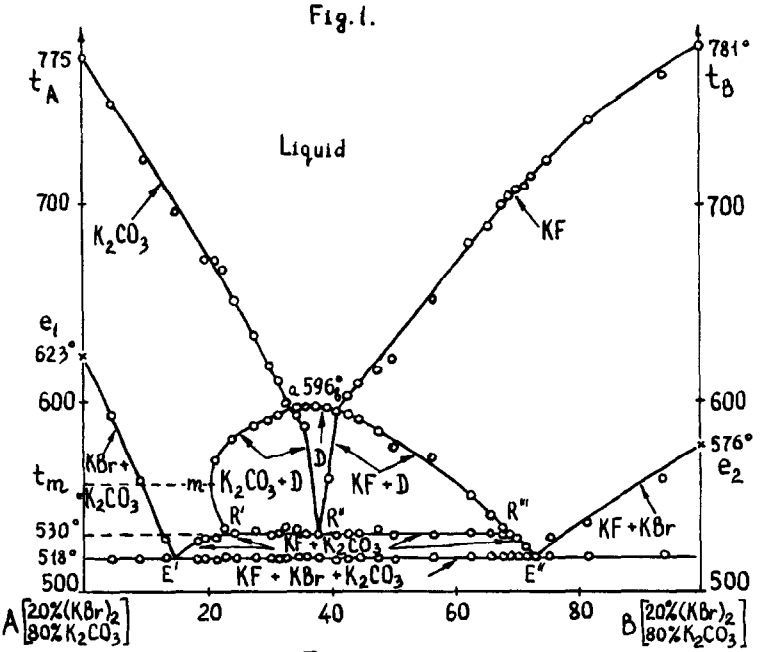
775
tA
781°
tB
Liquid
700
K2CO3
KF
e1
623°
600
a 596°
D
KBr+
K2CO3
tm
m
K2CO3+D
KF+D
R'
R''
R'''
530°
518°
KF+K2CO3
KF+KBr
E'
KF+KBr+K2CO3
E''
500
576°
e2
20
40
60
80
A [20%(KBr)2 80%K2CO3]
B [20%(KBr)2 80%K2CO3]

Fig 2.