Domains with the Reaction Type Change in the 3-Phase Regions of the Ternary Salt Systems

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Three-phase equilibrium in the isobaric ternary system could be either eutectic – with the both solid phases mass increasing, or peritectic – with the one solid mass decreasing. First method to check the terms for the change of three phase transformation type was named as a tangent method [1, 2]. Though it's correctness was restricted for the cases with the solubility in solids yet in 1945 [3], for the long time this method was preferable [4-8]. Some attempts were made to improve the tangent method [8, 9], but without the notable success.

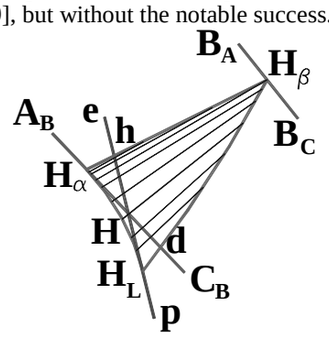

Figure 1. Lines of zero value of mass increments for the solid phase β

Next method to determine the boundaries for the three-phase region fragment with the change of phase transformation type was based on the transposition of thermodynamic system equilibrium equation [10-11]. Further developments of M.Hillert's and A.Prince's ideas succeeds the elaboration of software [12], that permits (Figure 1, 2): 1) to calculate the temperature of the three-phase transformation type change; 2) to get at any temperature the straight line for the compositions with the zero value of mass increment for the solid phase that divides eutectic and peritectic states; 3) to divide the concentration projection of three-phase fragment into three domains with eutectic, peritectic and mixed type of reaction; 4) to divide the three-phase region into the fragments with the eutectic or peritectic type of state ; 5) to investigate the fragment with the change of three-phase equilibrium type, in this case a ruled surface divides it for the domains with the different states.

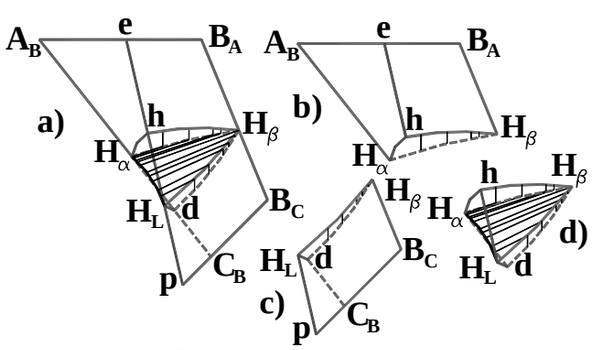

Figure 2. Three fragments of the three-phase region (a): b) eutectical; c) peritectical; d) mixed

Concentration space under the three-phase region is divided into 8 domains depended on the three-phase transformation types (Figure 3, Table). These 8 domains differ by the microstructure elements origin: primary α^1 and β^1 or eutectical α^e and β^e crystals, peritectical reaction products α^p and signed as $\beta^{1(res)}$ and $\beta^{e(res)}$ the residuum of β crystals after the peritectical reaction.

Table

Microstructures formation within the three-phase region domains (Figure 3)

Concentration domain	Microstructure
1	$\alpha^1+\alpha^e+\beta^e$
2	$\alpha^e+\beta^1+\beta^e$
3	α^p
4	$\alpha^p+\beta^{1(res)}$
5	$\alpha^1+\alpha^e+\alpha^p+\beta^{e(res)}$
6	$\alpha^e+\alpha^p+\beta^{1(res)}+\beta^{e(res)}$
7	$\alpha^1+\alpha^e+\alpha^p$
8	$\alpha^e+\alpha^p$

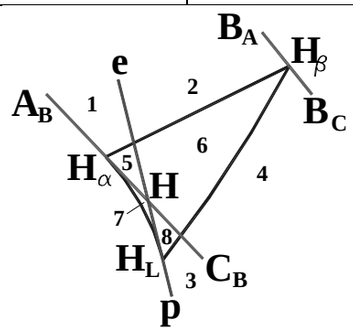

Figure 3. Concentration domains as the projections of three-phase region fragments

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