CONSTRUCTION OF A DIAGRAM OF THE STATE OF THE TRIPLE SYSTEM OF NAPHTHALENE-DIPHENYL-DIBENZYL WITH SUPERCOOLING

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Non-equilibrium phase diagrams of the naphthalene-diphenyl, naphthalene-bibenzyl and diphenyl-bibenzyl systems were plotted under the same experimental conditions. Thereby we need to merge them into a single tripple system.

As we can see from expanded phase diagram of naphthalene-diphenyl-bibenzyl (N-Dp-Db) system, there is a trend to reduce liquidus temperature as each binary alloy approaches the corresponding eutectic compositions E1, E2, E3. Point E represents the ternary eutectic in the center of the concentration triangle. According to the literature [1] the composition of the ternary eutectic is 27 mol% of N (21.9 wt% of N) + 33.8 mol% of Dp (33 wt% of Dp) + 39.2 mol% of Db (41.5 wt% of Db). The temperature of the triple eutectic point E is equal to TE=290.4 K. In order to check the parameters of the triple eutectic, we use the corresponding parameters of the binary eutectic in mass percent 40% N+60% Dp (TE1≈312 K); 51% Dp+49% Db (TE2≈303 K); 68% Db+32%N (TE3≈304 K).

The estimated composition of ternary eutectic and its temperature have been found using the conditions of phase equilibrium on the phase boundary between liquid and liquid-solid state, which is expressed by the equality to zero of the change in Gibbs energy. In the approximation of ideal solutions, this condition is represented by the following system of equations: $\Delta HN(1-T/TN)+RTlnxN=0$, $\Delta HDp(1-T/TDp)+RTlnxDp=0$, $\Delta HDb(1-T/TDb)+RTlnxDb=0$, $xN+xDp+xDb=1$.

Solving the system of equations numerically, we have found the composition of the ternary eutectic and its equilibrium temperature: TE = 293 K, xN = 26.9 mol%, xDp = 32.8 mol%, xDb = 40.3 mol%. Expressing the coordinates of ternary eutectic alloy in mass fractions, we get: xN =21.8 %, xDp =31.9 %, xDb = 46.3%.

It is seen that the parameters of the ternary eutectic are in good agreement with the literature.

References:

1. STANLEY M. WALAS. 1985. *Phase Equilibria in Chemical Engineering.* Butterworth-Heinemann