EXPERIMENTAL STUDY OF THE Tb-Cu-Sn TERNARY SYSTEM

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Study of the metallic systems by isothermal sections at selected temperatures reveals information on the formation, stability, homogeneity range and crystal structure of the intermetallics. The R-Cu-Sn (R- rare earths) systems were studied for the most rare earths [1,2] except Eu, Tb, and Tm. The phase relations in the Tb-Cu-Sn system were studied at 670 K using X-ray diffractometry and Scanning Electron Microscopy. According to performed X-ray and EPM analyses the Tb-Cu-Sn system at 670 K is characterized by formation of five ternary compounds (Fig. 1, Table). SEM-pictures of some alloys are shown in Fig. 2. The interstitial-type of the solid solution $TbCu_xSn_2$ based on the $TbSn_2$ ($ZrSi_2$-type) binary was observed up to 4 at.% Cu (a = 0.4397(4), b = 1.6211(2), c = 0.4326(3) nm for $Tb_{32}Cu_4Sn_{64}$). Solubility of Sn in the $TbCu_5$ binary ($AuBe_5$-type) extends up to 5 at.%. Significant solubility of the third component in the other binaries was not observed under used conditions.

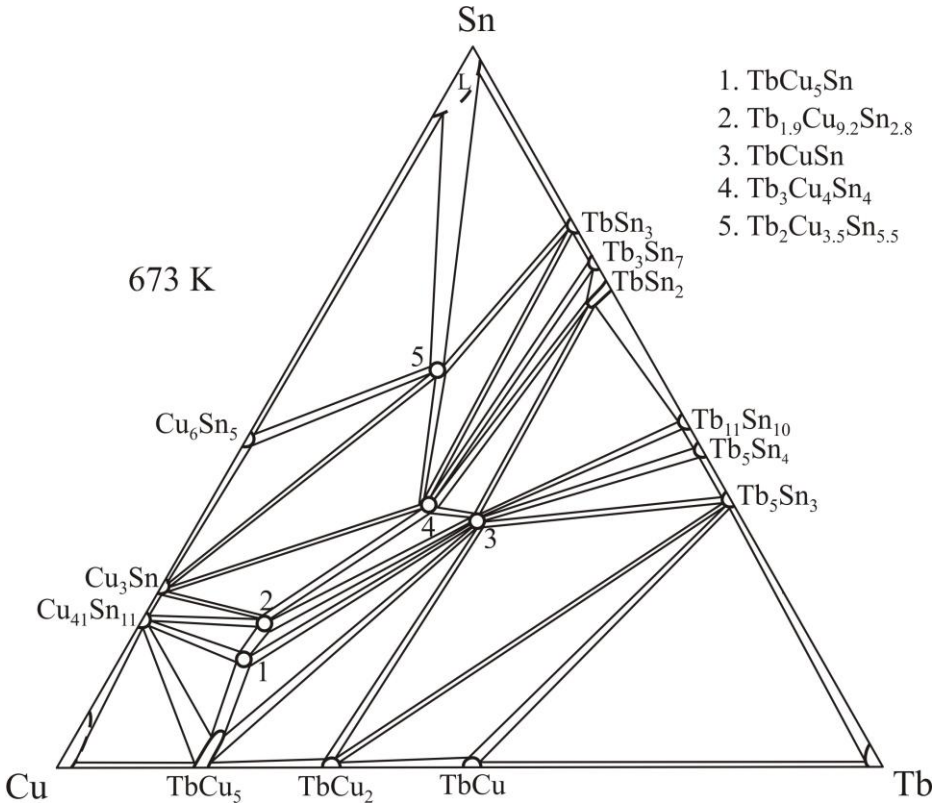

Fig. 1 Isothermal section of the Tb–Cu–Sn system at 670 K

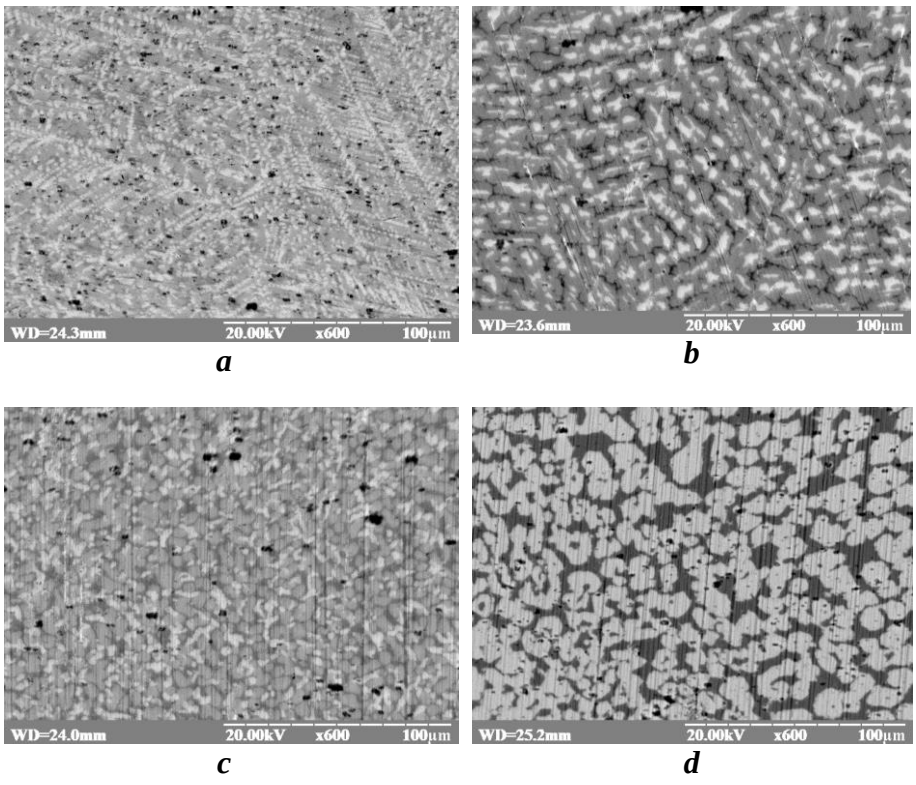

Fig. 2 SEM pictures of the Tb-Cu-Sn alloys: *a*) $Tb_{50}Cu_{40}Sn_{10}$ (TbCu–grey phase, $TbCu_2$–dark phase, Tb_5Sn_3-light phase); *b*) $Tb_{17}Cu_{66}Sn_{17}$ ($TbCu_5Sn$–grey phase, TbCuSn–light phase, $Tb_{1.9}Cu_{9.2}Sn_{2.8}$– dark phase); *c*) $Tb_{35}Cu_{45}Sn_{20}$ (TbCuSn– grey phase, Tb_5Sn_3– light phase, $TbCu_2$– dark phase); *d*) $Tb_{13}Cu_{57}Sn_{30}$ ($Tb_3Cu_4Sn_4$– light phase, Cu_3Sn – dark phase).

Table

Crystallographic characteristics of the ternary compounds in the Tb-Cu-Sn system

Compounds	Structure type	Lattice parameters, nm		
		a	*b*	*c*
$TbCu_5Sn$	$CeCu_5Au$	0.82205(1)	0.4978(3)	1.0576(6)
$Tb_{1.9}Cu_{9.2}Sn_{2.8}$	$Dy_{1.9}Cu_{9.2}Sn_{2.8}$	0.50355(9)	-	2.0414(6)
TbCuSn	LiGaGe	0.4517(2)	-	0.7272(3)
$Tb_3Cu_4Sn_4$	$Gd_3Cu_4Ge_4$	0.4421(3)	0.6939(3)	1.4547(5)
$Tb_2Cu_{3.5}Sn_{5.5}$	$Sm_2Cu_4Sn_5$	0.4404(4)	-	2.5854(3)

The investigated Tb-Cu-Sn and previously studied R-Cu-Sn systems with heavy rare earths showed a close analogy in stoichiometry and crystal structure of the most formed ternary compounds (except Yb-Cu-Sn system). Similarity of the all systems is demonstrated by the formation of the compounds RCuSn, $R_3Cu_4Sn_4$, $R_{1.9}Cu_{9.2}Sn_{2.8}$ and RCu_5Sn. The stannides with $Sm_2Cu_4Sn_5$ structure type realize in the systems with Gd, Tb and Dy.

1. Skolozdra R.V.: in: K.A. Gschneidner, Jr. and L. Eyring (Eds.), Handbook on the Physics and Chemistry of Rare Earths. - 1997. - 24

2. Romaka V.V., Romaka L.P., Krajovskyj V.Ya., Stadnyk Yu.V. Stannides of rare earth and transition metals. Lviv Polytech. Univ. - 2015, - 221 p.