

Supplementary Materials

**Summary of TI-LLST suggested by the resistivity phenomena.
(126 liquid systems)**

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Ag-Sn {-3} [51] (Sn-Ag-X)	Sn-Ag3.5	eutectic ($\beta\text{Sn}+\text{Ag}_3\text{Sn}$)	5 °C/min: 901–1087	Hump pattern	No abnormality	-	[1]
	Sn97Ag2.5Cu0.5	Hypo-eutectic	5 °C/min: 389–498, 596–780	Two Z pattern	Reversible at 671–627 °C	-	[1]
	Sn96.8Ag2.5Cu0.7	Hypo- eutectic	5 °C/min: 414–475, 547–783	Two Z pattern	Reversible at 694–628 °C	-	[1]
	Sn96.5Ag2.5Cu1.0	Hypo-eutectic	5 °C/min: 504–783	Two Z pattern	Reversible at 690–610 °C	-	[1]
	Sn96Ag3.5Cu0.5	eutectic	5 °C/min: 375–880	Two Z pattern	Reversible at 725–690 °C	-	[1]
	Sn95.8Ag3.5Cu0.7	eutectic	5 °C/min: 410–1050	Z pattern+S pattern	Reversible at 678–621 °C	Reversible Around 650 °C	[1]
	Sn95.5Ag3.5Cu1.0	eutectic	5 °C/min: 443–897	Z pattern+S pattern	Reversible at 657–572 °C	-	[1]
	Sn-3.5Ag-2Bi	Near eutectic with Ag_3Sn	5 °C/min: 869	Turning point	Abnormal at 702–665 °C	Reversible around 680 °C	[2]
	Sn-3.5Ag-3.5Bi	Near eutectic with Ag_3Sn	5 °C/min: 814–1120	Hump	Abnormal at 695–654 °C	Reversible around 670 °C	[2,3]
	Sn-3.5Ag-5Bi	Near eutectic with Ag_3Sn	5 °C/min: 728–1145	Hump	Abnormal at 673–625 °C	Reversible around 655 °C	[2]
	Sn-3.5Ag-7Bi	Near eutectic with Ag_3Sn	5 °C/min: 853	Turning point	Abnormal at 713–655 °C	Reversible around 685 °C	[2]
Al-Si	Al-Si18	Hyper-eutectic	5 °C/min: 1050	Turning point	-	-	Not published

Cont.

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	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Bi-In {-1} [51] {-1.8} [52]	Bi-In33	Left near BiIn	5 °C/min: 780	Turning point	-	-	[4]
	Bi-In38	Hypo-peritectic (BiIn+Bi ₃ In ₅)	5 °C/min: 755	Turning point	-	-	[4]
	Bi-In50.5	Hypo-eutectic, (Bi ₃ In ₅ +BiIn ₂)	5 °C/min: 735	Turning point	-	-	[4]
	Bi-In66	Eutectic (Bi ₃ In ₅ +BiIn ₂)	5 °C/min: 815	Turning point	-	-	[4]
Bi-Pb {0} [51] {-1} [52]	Pb-Bi6	Solid-solution	5 °C/min: 813–1136	Hump	No abnormality	No abnormality	[5]
	Pb-Bi30	Near peritectic (ϵ)	7.5 °C/min: 730	Turning point	-	-	[6]
	Pb-Bi32	Hyper-peritectic (ϵ)	5 °C/min: 854–1154	Hump	No abnormality	No abnormality	[7]
	Pb-Bi56.1	eutectic (ϵ +Bi)	3 °C/min: 538–727	Sunk	No abnormality	-	[8]
	Pb-Bi65	Hyper-eutectic (ϵ +Bi)	5 °C/min: 600	Turning point	-	-	[6]
	Pb-Bi70	Hyper-eutectic (ϵ +Bi)	7.5 °C/min: 854–1199	Hump	No abnormality	No abnormality	[7]
	Pb-Bi80	Hyper-eutectic (ϵ +Bi)	3 °C/min: 520–726	Hump	No abnormality	-	[8]
Bi-Sb {1} [51,52]	Bi-Sb10	Isomorphous system	5 °C/min: 805–1065	Hump	No abnormality	No abnormality	[9]
	Bi-Sb20	Isomorphous system	5 °C/min: 829–1107	Hump	No abnormality	No abnormality	[9]
	Bi-Sb30	Isomorphous system	5 °C/min: 815–1119	Hump	No abnormality	No abnormality	[9]
	Bi-Sb40	Isomorphous system	5 °C/min: 903–1126	Hump	No abnormality	-	[9]
	Bi-Sb50	Isomorphous system	5 °C/min: 824–1135	Hump	No abnormality	-	[9]

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Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Bi-Sn {1} [51]	Sn-Bi1	Solid solution (βSn)	5 °C/min: 815–960	S pattern	Abnormal at 683–665 °C	-	[10]
	Sn-Bi6	Solid solution (βSn)	5 °C/min: 830–970	S pattern	Abnormal at 690–630 °C	-	[10]
	Sn-Bi10	Solid solution (βSn)	5 °C/min: 812–965	S pattern	Abnormal at 680–636 °C	-	[10]
	Sn-Bi20	Solid solution (βSn)	5 °C/min: 725–1070	S pattern	-	-	[11]
	Sn-Bi30	Hypo-eutectic ($\beta\text{Sn}+\text{Bi}$)	5 °C/min: 755–1020	S pattern	-	-	[11]
	Sn-Bi40	Hypo-eutectic ($\beta\text{Sn}+\text{Bi}$)	5 °C/min: 762–885	S pattern	-	-	[12]
	Sn-Bi57	eutectic ($\beta\text{Sn}+\text{Bi}$)	5 °C/min: 785–860	S pattern	Abnormal at 643–582 °C	-	[11]
	Sn-Bi57-Ag1	-	5 °C/min: 865–983	Turning point	Abnormal at 722–665 °C	-	[13]
	Sn-Bi70	Hyper-eutectic ($\beta\text{Sn}+\text{Bi}$)	5 °C/min: 766–965	S pattern	Abnormal at 695–663 °C	Reversible around 695 °C	[37]
	Sn-Bi80	Hyper-eutectic ($\beta\text{Sn}+(\text{Bi})$)	5 °C/min: 880–965	S pattern	No abnormality	-	[11]
	Sn-Bi90	Hyper-eutectic ($\beta\text{Sn}+(\text{Bi})$)	5 °C/min: 854–990	S pattern	No abnormality	-	[11]

Cont.

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Bi-Te	Bi-Te2.4	Near eutectic (Bi+Bi ₇ Te ₃)	10 °C/min: 590–616	S pattern	No abnormality	-	[16]
	Bi-Te10	Hyper-eutectic (Bi+Bi ₇ Te ₃)	10 °C/min: 490–554, 639–708	Two Z pattern	No abnormality	-	[16,17]
	Bi-Te20.5	Hyper-eutectic (near Bi ₇ Te ₃)	10 °C/min: 643–668	Z pattern	No abnormality	-	[16]
	Bi-Te40	between BiTe and Bi ₆ Te ₇	10 °C/min: 695–723	Hump	No abnormality	-	[30]
	Bi-Te47.8	Bi ₂ Te ₃	10 °C/min: 686–707	Z pattern	No abnormality	-	[16]
	Bi-Te60	Hypo-eutectic (Bi ₂ Te ₃ +Te)	10 °C/min: 798–829	Hump	No abnormality	-	[18]
	Bi-Te80	Hypo-eutectic (Bi ₂ Te ₃ +Te)	10 °C/min: 746–780	Hump	No abnormality	-	[18]
	Bi-Te85	Hyper-eutectic (Bi ₂ Te ₃ +Te)	10 °C/min: 570–579	Z pattern	No abnormality	-	[16]
Bi _x Sb _{2-x} Te ₃ (molar concentration)	Bi _{0.3} Sb _{1.7} Te ₃	Intermetallic phase+Te	10 °C/min: 932–1020	Hump	No abnormality	-	[19]
	Bi _{0.6} Sb _{1.4} Te ₃	Intermetallic phase+Te	10 °C/min: 932–1020	Hump	No abnormality	-	[20]
	Bi _{0.8} Sb _{1.2} Te ₃	Intermetallic phase+Te	10 °C/min: 928–1072	Hump	No abnormality	-	[20]
	Bi _{1.0} Sb _{1.0} Te ₃	Intermetallic phase+Te	10 °C/min: 943–973	Hump	No abnormality	-	[20]

Cont.

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Cu-Sb {7} [51]	Cu-Sb70	Hypo-eutectic (Cu ₂ Sb+Sb)	5 °C/min: 1014–1056	Z pattern	Abnormal at 885–820 °C	Reversible Heat: 940–950 °C Cool: 885–820 °C	[21]
	Cu-Sb76.5	Eutectic (Cu ₂ Sb+Sb)	5 °C/min: 830–1115	Hump	Abnormal at 810–730 °C	Reversible Heat: 870–810 °C Cool: 810–730 °C	[21]
	Cu-Sb90	Hyper-eutectic (Cu ₂ Sb+Sb)	5 °C/min: 740–850	Hump	Abnormal at 810–710 °C	Reversible Around 780 °C	[22]
Cu-Sn {for ε : -8.4; For η : -6.1} [53]	Cu-Sn30	Solid-solution (left near ε)	3 °C/min: 855–1040	Complex abnormality	No abnormality	No abnormality	[23]
	Cu-Sn40	Hypo- peritectic (near right η)	5 °C/min: 785–840	Turning point	No abnormality	-	[24]
	Cu-Sn50	Hypo- peritectic (ε + η)	5 °C/min: 815–900	Turning point	No abnormality	-	[24]
	Cu-Sn60	Peritectic (η)	5 °C/min: 755–795	Turning point	No abnormality	-	[24]
	Cu-Sn70	Hypo-eutectic (η +(Sn))	5 °C/min: 720–770	Turning point	No abnormality	-	[16]
	Cu-Sn80	Hypo-eutectic (η +(Sn))	3 °C/min: 702–806, 967–1033	Two Humps	Abnormal at 700–630 °C	Reversible Heat: 755–800 °C Cool: 700–630 °C	[25]
	Cu-Sn99.3	Eutectic (η +(Sn))	5 °C/min: 825–1066	Hump	Abnormal at 670–620 °C	Reversible Heat: 805–720 °C Cool: 700–630 °C	[26]
	Sn-0.7Cu-3Bi		5 °C/min: 328–388, 837–943	Z pattern+S pattern	Abnormal around 610 °C	Reversible Around 680 °C	[26]

Cont.

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Cu-Sn {for ε : -8.4; For η : -6.1} [53]	Sn-0.7Cu-5Bi		5 °C/min: 753–1112	Hump	Abnormal at 680–640 °C	Reversible Heat: 805–750 °C Cool: 680–620 °C	[26]
	Sn-0.7Cu-7.5Bi		5 °C/min: 733–1165	Hump	Abnormal at 690–640 °C	Reversible Heat: 795–730 °C Cool: 695–660 °C	[26]
	Sn-0.7Cu-10Bi		5 °C/min: 830–1040	S pattern	Abnormal at 680–660 °C	Reversible Heat: 770–730 °C Cool: 680–660 °C	[26]
Cu-Zr {-23} [51] (molar concentration)	Cu ₅₀ Zr ₅₀ ($T_L = 935^\circ\text{C}$)	Intermetallic phase CuZr	10 °C/min: 1210, 1360	Two turning zones	-	-	[51]
	Cu ₆₄ Zr ₃₆ ($T_L = 945^\circ\text{C}$)	Between CuZr and CuZr ₂	10 °C/min: 1100–1400	Complex abnormality	-	-	[51]
In-Pb {-1} [51]	Pb-In20	Solid solution ((Pb))	5 °C/min: 795–917	S pattern	-	-	[27]
	Pb-In40	Solid solution ((Pb))	5 °C/min: 767–1067	S pattern	-	-	[28]
	Pb-In63	peritectic	5 °C/min: 826–1086	Hump	-	-	[28]
	Pb-In70.6	Solid solution	5 °C/min: 779–988	S pattern	-	-	[28]
	Pb-In89.75	Solid solution ((In))	5 °C/min: 669–996	S pattern	-	-	[28]

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	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
In-Sn {0} [51] {-0.5} [52]	In-Sn10	Solid-solution ((In))	5 °C/min: 660–1045	S pattern	No abnormality	-	[29]
	In-Sn20	Hyper-peritectic (β)	5 °C/min: 495–1000	S pattern	No abnormality	-	[29]
	In-Sn30	Hyper-peritectic (β)	5 °C/min: 734–980	S pattern	No abnormality	-	[40]
	In-Sn40	Hypo-eutectic ($\beta+\gamma$)	7.5 °C/min: 861	Z pattern	Abnormal at 750–855 °C	-	[7,40]
	In-Sn49.1	eutectic ($\beta+\gamma$)	3 °C/min: 620–850	Sunk	No abnormality	No abnormality	[40,49]
	In-Sn60	Hyper-eutectic ($\beta+\gamma$)	5 °C/min: 535–645	S pattern	-	-	[32]
	In-Sn70	Hyper-eutectic ($\beta+\gamma$)	5 °C/min: 203	Turning point	No abnormality	No abnormality	[31,40]
	In-Sn80	Hypo-peritectic (γ)	3 °C/min: 635–750 5 °C/min: 789–981	S pattern	No abnormality	No abnormality	[27,40]
In-Sb {-1} [51] {-3.5} [52]	In-Sb10	Hyper-eutectic ((In)+ α InSb)	No transition	-	-	-	[15]
	In-Sb30	Hyper-eutectic ((In)+ α InSb)	No transition	-	-	-	[15]
	In-Sb50	Hyper-eutectic ((In)+ α InSb)	No transition	-	-	-	[15]
	In-Sb69.5	eutectic (α InSb+(Sb))	No transition	-	-	-	[15]
	In-Sb90	Hyper- eutectic (α InSb+(Sb))	5 °C/min: 873–1119	Hump	No abnormality	-	[33]

Cont.

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Pb-Sb {1} [51]	Pb-Sb5.8	Hypo-eutectic ((Pb)+(Sb))	2 °C/min: 572, 700–792	Turning point +Hump	No abnormality	-	[23]
	Pb-Sb30	Hyper-eutectic ((Pb)+(Sb))	5 °C/min: 843–1020	S pattern	No abnormality	No abnormality	[14]
	Pb-Sb90	Hyper-eutectic ((Pb)+(Sb))	7.5 °C/min: 861–1100	Hump	No abnormality	-	[34]
Pb-Sn {2} [51]	Pb-Sn20	Hypo- eutectic ((Pb)+(βSn))	5 °C/min: 722 7 °C/min: 876	Turning point	7 °C/min: Abnormal from 796 °C	Reversible Around 800 °C	[35,36]
	Pb-Sn40	Hypo- eutectic ((Pb)+(βSn))	5 °C/min: 765	Turning point	Abnormal from 738 °C	Reversible Around 738 °C	[35,36]
	Pb-Sn61.9	eutectic ((Pb)+(βSn))	7 °C/min: 780	Turning point	Abnormal from 693 °C	-	[36]
	(Pb-Sn61.9)-Bi10	-	10 °C/min: 771–885	Z pattern	Abnormal at 610–777 °C	-	[38]
	(Pb-Sn61.9)-Bi15	-	10 °C/min: 942–1030	S pattern	No abnormality	-	[38]
	(Pb-Sn61.9)-Bi32	-	10 °C/min: 731	Turning point	Abnormal At 600–736 °C	-	[38]
	(Pb-Sn61.9)-Bi50	-	10 °C/min: 716	Turning point	Abnormal at 573–720 °C	-	[38]
	(Pb-Sn61.9)-Bi70	-	10 °C/min: 695	Turning point	Abnormal at 548–695 °C	-	[38]
	(Pb-Sn61.9)-Bi90	-	10 °C/min: 849–991	S pattern	No abnormality	-	[38]
	Pb-Sn80	Hyper-eutectic ((Pb)+(βSn))	5 °C/min: 670–712	Z pattern	-	-	[35]

Cont.

Alloy System { ΔH_{mix} }, kJ/mol	Composition		Abnormality during 1st heating		Reversibility		Refs.
	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Pb-Te {for PbTe: -25} [53]	Pb-Te3	Hyper-eutectic ((Pb)+PbTe)	6 °C/min: 821	Turning point	No abnormality	-	[39]
	Pb-Te70	Hypo-eutectic (PbTe+(Te))	6 °C/min: 653–665	Z pattern	No abnormality	-	[39]
	Pb-Te75	Hypo-eutectic (PbTe+(Te))	6 °C/min: 624–635	Hump	No abnormality	-	[39]
	Pb-Te83.4	eutectic (PbTe+(Te))	6 °C/min: No transition	-	-	-	[39]
	Pb-Te90	Hyper-eutectic (PbTe+(Te))	6 °C/min: No transition	-	-	-	[39]
Pb-Zn {5} [51]	Pb-Zn10	Hypo-eutectic ((Zn)+(Pb))	5 °C/min: No transition	-	-	-	[40]
	Pb-Zn20	Hypo-eutectic ((Zn)+(Pb))	5 °C/min: No transition	-	-	-	[40]
	Pb-Zn30	Hypo-eutectic ((Zn)+(Pb))	5 °C/min: No transition	-	-	-	[40]
Sn-Sb {-1} [51] {-1.3} [52]	Sn-Sb10	left near peritectic	5 °C/min: 856–1077	S pattern	No abnormality	-	[41–44]
	Sn-Sb15	hyper-peritectic	5 °C/min: 720–1078	Hump	Abnormal at 573–694 °C	Reversible Heat: 516–786 °C Cool: 578–700 °C	[45]
	Sn-Sb30	hyper-peritectic	5 °C/min: 876–1159	Hump	No abnormality	-	[42,46]
	Sn-Sb42	Solid-solution	5 °C/min: No transition	-	-	-	[42]
	Sn-Sb50	Solid-solution (β)	5 °C/min: No transition	-	-	-	[42,47]
	Sn-Sb70	hyper- peritectic	5 °C/min: No transition	-	-	-	[42]

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	(wt%)	Position in phase diagram	Temperature range / °C	Change pattern	1st cooling	In following heating & cooling	
Sn-Zn {3} [51]	Sn-Zn5	Hyper-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn8.8	Eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn20	Hyp0-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn30	Hyp0-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn40	Hypo-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn50	Hyper-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
	Sn-Zn70	Hyper-eutectic ((Zn)+(βSn))	5 °C/min: No transition	-	-	-	[48]
Sn-Te	Sn-Te3	Hyper-eutectic ((βSn)+SnTe)	6 °C/min: 585–623	S pattern	Abnormal at 569–619	Reversible Heating: 569–619 °C Cooling: 581–624 °C	[39]
Pure elements	In	Pure	5 °C/min: No transition	-	-	-	[29]
	Bi	Pure	5 °C/min: 826–1009	Hump	No abnormality	No abnormality	[15]
	Pb	Pure	5 °C/min: No transition	-	-	-	[35]
	Sb	Pure	5 °C/min: 844–1064	Hump	No abnormality	-	[15]
	Sn	Pure	7.5 °C/min: 815–1026	S pattern	Abnormal from 652 °C	Reversible around 650–750 °C	[15]
	Te	Pure	No transition	No abnormality	No abnormality	-	[16]
	Zn	pure	No transition	-	-	-	[48]

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