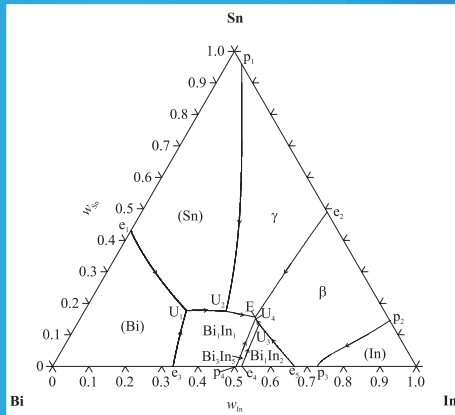# Bi-In-Sn-Zn system for lead-free soldering
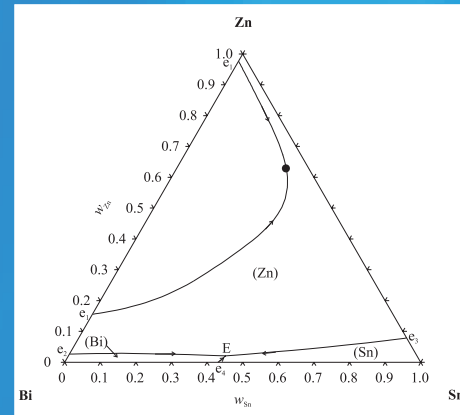
N. Moelans[1], K.C. Hari Kumar[2], P. Wollants[1]

[1]Departement Metaalkunde en Toegepaste Materiaalkunde, KULeuven, Belgium

[2]Dept. Metallurgical and Materials Engg., IIT Madras, Chennai 600 036, India

Liquidus Bi-In-Sn

Liquidus Bi-Sn-Zn

Thermodynamic descriptions for the four ternary subsystems are optimized using the CALPHAD method and combined to obtain a description for the quaternary Bi-In-Sn-Zn
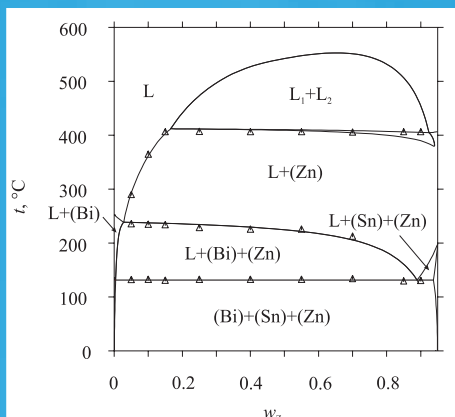
Binaries

D.Boa ⟶ Bi-In

B.-J. Lee ⟶ Bi-Sn, In-Sn*, In-Zn

D.V. Malakhov ⟶ Bi-Zn

S. Fries ⟶ Sn-Zn*

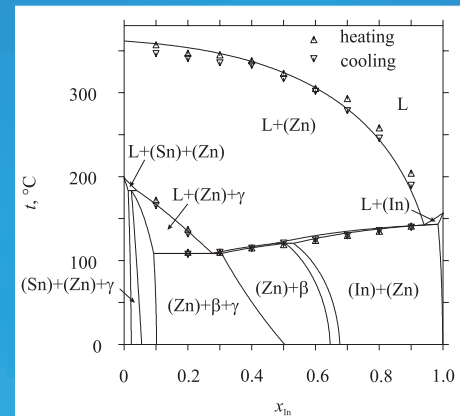* Some expressions were reoptimized to make all binaries compatible

Isopleth Bi-Sn-Zn
$w_{Sn}=0.05$

Experimental data from :
S.D. Muzaffar. J. Chem. Soc., 123, p 2341, 1923.

Vertical section In-Sn-Zn
Sn/Zn = 1/2

Experimental data from :
Y. Xie. Berich. Bunsen Gesellsch., 102, p 1334, 1998.

All quaternary reactions involving the liquid are calculated

⟶ lowest melting point in the Bi-In-Sn-Zn system :

Eutectic reaction : L ⟷ (Zn)+Bi$_3$In$_5$+β+γ

Temperature : 56.60 °C

Composition (wt.%) : 35.4 Bi; 48.2 In; 48.2 Sn; 0.4 Zn