

Ca-Sn (Calcium-Tin)

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The evaluated [Massalski2] diagram shows the existence of four phases, Ca_2Sn , $\text{Ca}_{31}\text{Sn}_{20}$, CaSn , and CaSn_3 , in the Ca-Sn system primarily on the basis of work by [1926Hum] and [1977For]. The liquidus boundaries were mostly speculative. In particular, the Ca_2Sn liquidus is unusually asymmetric [1994Oka].

Figure 1 shows the Ca-Sn phase diagram determined by [2000Pal] using differential thermal analysis, powder and single crystal x-ray diffraction, and metallographic analysis. Three additional phases were found in this system: Ca_5Sn_3 , Ca_7Sn_6 , and $\text{Ca}_{36}\text{Sn}_{23}$.

Because $\text{Ca}_{36}\text{Sn}_{23}$ and $\text{Ca}_{31}\text{Sn}_{20}$ are only ~ 0.2 at.% apart

Table 1 Ca-Sn crystal structure data

Phase	Composition, at.% Sn	Pearson symbol	Space group	Strukturbericht designation	Prototype
(β Ca)	0	<i>cI2</i>	$Im\bar{3}m$	A2	W
(α Ca)	0	<i>cF4</i>	$Fm\bar{3}m$	A1	Cu
Ca_2Sn	33.3	<i>oP12</i>	<i>Pnma</i>	C23	Co_2Si
Ca_5Sn_3	37.5	<i>tI32</i>	$I4/mcm$	$D8_1$	Cr_5B_3
$\text{Ca}_{36}\text{Sn}_{23}$	39.0	<i>tP118</i>	$P4/mbm$...	$\text{Yb}_{36}\text{Sn}_{23}$
$\text{Ca}_{31}\text{Sn}_{20}$	39.2	<i>tI204</i>	$I4/mcm$...	$\text{Pu}_{31}\text{Rh}_{20}$
Ca_7Sn_6	46.2	<i>oP52</i>	<i>Pnma</i>	...	Ca_7Sn_6
CaSn	50	<i>oC8</i>	$Cmcm$	B_f	CrB
CaSn_3	75	<i>cP4</i>	$Pm\bar{3}m$	$L1_2$	AuCu_3
(β Sn)	100	<i>tI4</i>	$I4_1/amd$	A5	βSn

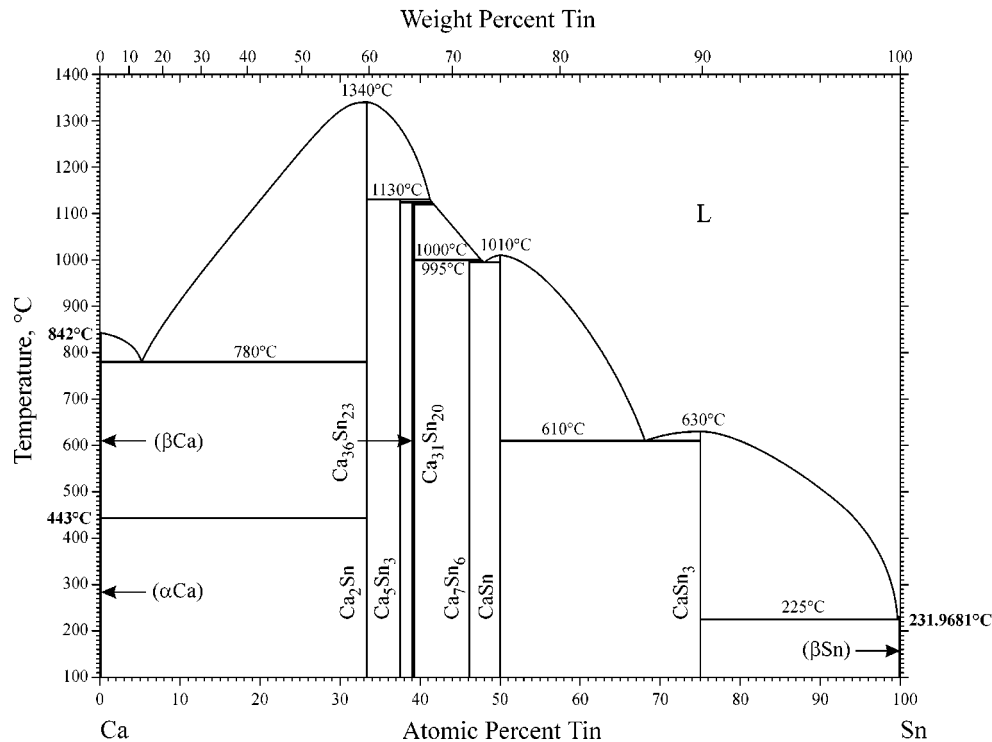


Fig. 1 Ca-Sn phase diagram

Section III: Supplemental Literature Review

and the space group $\text{Ca}_{36}\text{Sn}_{23}$ is a subgroup of the space group $\text{Ca}_{31}\text{Sn}_{20}$, it is likely that these two phases represent the compositional boundaries of a phase that undergoes a second-order transition with composition variation. Alternatively, either $\text{Ca}_{36}\text{Sn}_{23}$ or $\text{Ca}_{31}\text{Sn}_{20}$ is stable only in a very narrow temperature range [1993Oka]. Further investigation, particularly of the structural details, would be helpful.

Table 1 shows Ca-Sn crystal structure data, as given by [2000Pal].

References

- 1926Hum:** W. Hume-Rothery: *J. Inst. Met.*, 1926, vol. 35, pp. 319-35.
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2000Pal: A. Palenzona, P. Manfrinetti, and M.L. Fornasini: *J. Alloys Compounds*, 2000, vol. 312, pp. 165-71.