

Au – Zr (Gold – Zirconium)

Phase diagram

The phase diagram has been determined experimentally by Lomello-Tafin [97 Lom1]. As techniques have been used the differential thermal analysis, X-ray diffractography and the electron probe microanalysis. The resulting phase diagram has been redrawn by Okamoto [99 Oka]. From there information has been obtained to draw Fig. 1. This diagram, as Okamoto [99 Oka] stated, is more reliable than earlier published ones [85 Mas].

Due to [99 Oka] the intermediate phase Au_4Zr_5 mentioned by [90 Mas] does not exist. But two other compounds could be found, the dimorphic AuZr and Au_2Zr_3 .

Crystal structure

[97 Lom1] have discussed two new intermediate phases: AuZr and Au_2Zr_3 . Their crystallographic data are not known. Table 1 gives a survey on crystallographic data of all known intermediate phases.

Table 1. Au–Zr. Crystallographic data of intermediate phases.

Phase	Concentration [at% Zr]	Structure	Type	Lattice parameters [nm]			Reference
				<i>a</i>	<i>b</i>	<i>c</i>	
Au_4Zr	20	ort	Au_4Zr	0.4996	0.4845	1.4265	[62 Sto]
				0.5020	0.4864	1.435	[97 Lom1]
Au_3Zr	25	ort	Cu_3Ti	0.605	0.4855	0.4775	[59 Sch]
				0.608	0.489	0.479	[97 Lom1]
Au_2Zr	33.3	tet	MoSi_2	0.3525	-	0.87	[62 Sto]
				0.3555	-	0.876	[97 Lom1]
$\text{Au}_{10}\text{Zr}_7$	58.82	tet	$\text{Zr}_7\text{Ni}_{10}$	0.6952	-	1.3292	[62 Sto]
				0.6949	-	1.3272	[97 Lom1]
AuZr	55 - 47						[97 Lom1]
Au_2Zr_3	60						[97 Lom1]
AuZr_2	66.6	tet	MoSi_2	0.328	-	1.16	[62 Nev]
				0.3265	-	1.148	[97 Lom1]
AuZr_3	75	cub	Cr_3O	0.54824	-	-	[58 Nev]
				0.5488	-	-	[97 Lom1]

Thermodynamics

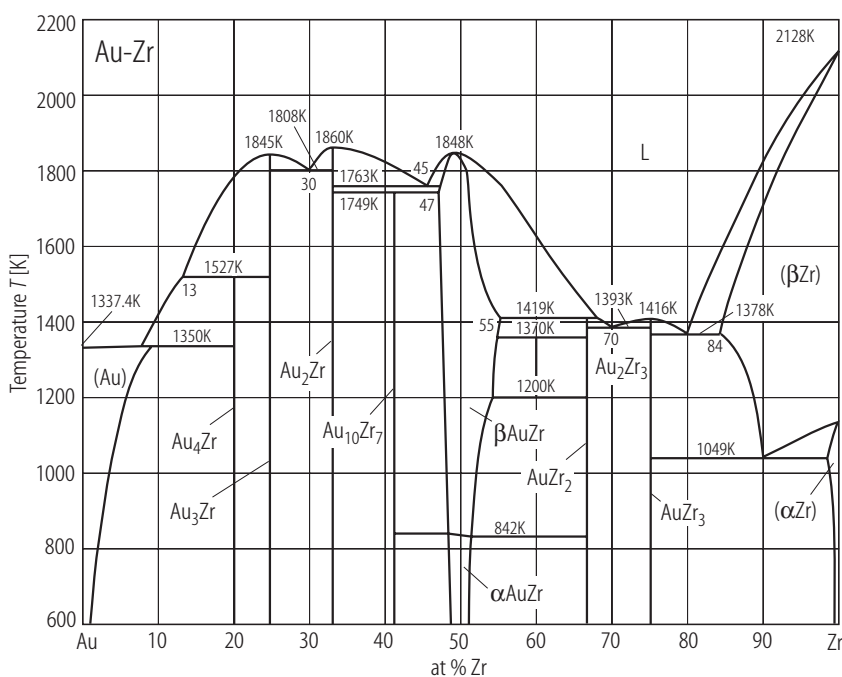
By direct reaction calorimetry Lomello-Tafin et al. [97 Lom2] have determined the enthalpy of formation of some intermediate phases at 1273 K. The results are given in Table 2.

Table 2. Au–Zr. Enthalpies of formation of intermediate phases in [kJ g-atom⁻¹]

Phase	ΔH^S [kJ g-atom ⁻¹]	Reference
Au ₁₀ Zr ₇	- 66.6 ± 2.4	[97 Lom2]
AuZr	- 59.7 ± 0.9	[97 Lom2]
AuZr ₃	- 39.7 ± 1.0	[97 Lom2]
Au ₄ Zr ₅	- 47.15 ± 3.04	[92 Fit]
Au ₂ Zr	- 61.00 ± 2.34	[92 Fit]
Au ₃ Zr	- 51.41 ± 2.93	[92 Fit]

Enthalpies of mixing of liquid Au-rich alloys have been determined by Fitzner et al. [92 Fit] using high-temperature calorimetry. The results are plotted in Fig. 2 and Fig. 3. In Fig. 3 only at low concentrations the reliability has been corroborated.

Figures

**Fig. 1. Au–Zr.** Phase diagram [99 Oka].

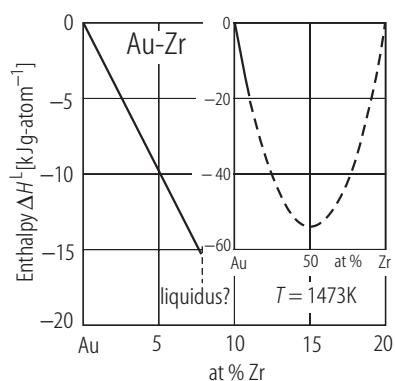


Fig. 2. Au–Zr. Enthalpies of mixing of liquid alloys with high Au-concentrations [92 Fit].

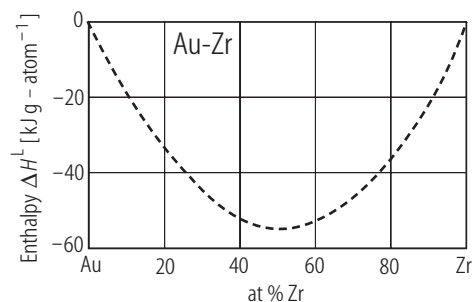


Fig. 3. Au–Zr. ΔH^S obtained mainly by model calculations [92 Fit].

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