The Hg-Pa (Mercury-Protactinium) System

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The Hg-Pa phase diagram is not available, and no experimental material on this system is known. Hg melts at −38.8290 °C, and Pa melts at 1572 °C [Massalski2]. The allotropic phase transformation αPa ↔ βPa occurs at 1170 °C. By similarity to the neighboring elements (Th and U) in the periodic table, Pa should react with Hg to form stable intermetallics that probably decompose at temperatures higher than the boiling point of Hg (356.623 °C) at normal pressure. The expected stoichiometries of the Hg-Pa compounds are 45 to 11, 3 to 1, 2 to 1, and 1 to 1. The solubility of Pa in liquid Hg was predicted by [1989Gum] and should be on the order of 10^{-3} at.% Pa at 25 °C as the mean value of the solubilities measured for Th and U. The crystal structures of pure components of the system are listed in Table 1.

Reference

1989Gum: C. Gumiński, Selected Properties of Simple Amalgams, *J. Mater. Sci.,* Vol 24, 1989, p 2661-2676 (Review)

Table 1 Hg-Pa crystal structure and lattice parameter data

Phase	Pearson symbol	Space group	Strukturbericht designation	Prototype	Lattice parameters, nm		Temperature, °C	Reference
					a	*c*		
Hg	*hR*1	$R\bar{3}m$	*A*10	αHg	0.3005	α = 70.53°	−48	[Massalski2]
αPa	*tI*2	*I4/mmm*	A_a	αPa	0.3921	0.3235	25	[Massalski2]
βPa	*cI*2	$Im\bar{3}m$	*A*2	W	0.381	…	>1170	[Massalski2]