

# The Hg-Xe System (Mercury-Xenon)

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## Equilibrium Diagram

No phase diagram is available for the Hg-Xe system. The melting point of Hg is  $-38.8290\text{ }^{\circ}\text{C}$  [90ITS], and the triple point of Xe is  $-111.7582\text{ }^{\circ}\text{C}$  [Melt]. At pressure of  $0.101325\text{ MPa}$ , Hg and Xe boil at  $356.623$  and  $-108.12\text{ }^{\circ}\text{C}$ , respectively.

A solubility of Xe in liquid Hg at  $0.101\text{ MPa}$  was determined by [59Mit]. The experimental method consisted of saturating the Hg with radioactive Xe, transferring the solution to a vessel evacuated of Xe at the time of transfer, and determining the activity of the desorbed Xe. The solubility equation was reported in the form:

$$\log(\text{atomic fraction Xe}) = -0.2 - 2565/T \quad (\text{Eq 1})$$

where  $T$  is in Kelvin, with spread of the data within two orders of magnitude. The calculated solubility from Eq 1 at  $25\text{ }^{\circ}\text{C}$  is  $2 \times 10^{-7}$  at.% Xe, whereas a calculated solubility from a model of the regular solution is  $8 \times 10^{-17}$  at.% Xe. [79Eps] found that the transition temperature of superconductivity depended on the composition of the Hg-Xe alloy at  $\sim 4\text{ K}$ . However, no information about the homogeneity of such an alloy was given that could be related to the Hg-Xe phase diagram. [77Che] measured conductivity of the Hg-Xe mixtures with up to 31

at.% Xe at  $6\text{ K}$  and expressed opinion that the Hg-Xe system is microscopically inhomogeneous in these conditions.

[65Gme] reported the formation of unstable HgXe molecules in the gas phase during electric discharge, but no compounds were identified in the condensed state.

## Crystal Structures and Lattice Parameters

Table 1 lists Hg-Xe crystal structure and lattice parameter data.

### Cited References

- 59Mit:** C. Mitra, "Solubility of Xe in Liquid Metals," Ph.D. thesis, Columbia University, NY (1959); *Diss. Abstr.*, 22, 100 (1961). (Equi Diagram; Experimental)
- 65Gme:** Gmelin, "Hg and Noble Gases," *Gmelins Handbuch, Mercury*, Verlag Chemie, Weinheim, 34, Pt. 1B, 1-2 (1965) in German. (Equi Diagram; Review)
- 77Che:** O. Cheshnovski, U. Even, and J. Jortner, "Metal-Insulator Transition in the Hg-Xe System," *Solid State Commun.*, 22, 745-748 (1977). (Equi Diagram; Experimental)
- 79Eps:** K. Epstein, E.D. Dahlberg, and A.M. Goldman, "Superconductivity and the Metal-Nonmetal Transition in Hg-Xe Films," *Phys. Rev. Lett.*, 43, 1889-1892 (1979). (Equi Diagram; Experimental)
- 90ITS:** "The International Temperature Scale of 1990," *Bull. Alloy Phase Diagrams*, 11, 107-108 (1990). (Equi Diagram; Review)

**Table 1 Hg-Xe Crystal Structure and Lattice Parameter Data**

Phase	Composition, at.% Xe	Pearson symbol	Space group	Strukturbericht designation	Prototype	Lattice parameters, nm	Comment
Hg.....	0	<i>hR1</i>	$R\bar{3}m$	A10	$\alpha\text{Hg}$	0.3005	$\alpha=70.53^{\circ}$ At $-48\text{ }^{\circ}\text{C}$
Xe.....	100	<i>cF4</i>	$Fm\bar{3}m$	A1	Cu	0.6350	At $<42\text{ K}$

From [Massalski2].

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