The crystal structures and lattice parameters of the pure elements are given in Table 2.

Cited References

68Gul: B.B. Gulyaev and G.F. Dvorshkaya, "Generalization of the Phase Diagram of Binary Copper-, Silver-, and Gold-Base Alloys," in *Phase Diagrams of Metallic Systems*, E.M. Savitskii, Ed., Akad. Nauk SSSR, 267-273 (1968) in Russian. (Equi Diagram; Theory)

81Kir: R.E. Kirk and D.F. Othmer, *Encyclopedia of Chemical Technology*, Vol. 12, 3rd ed., Interscience Publishers, New York, 254 (1981). (Equi Diagram; Compilation)

Au–inert gases evaluation contributed by **H. Okamoto** and **T.B. Massalski,** Department of Metallurgical Engineering and Materials Science, Carnegie-Mellon University, Pittsburgh, PA 15213, USA. Work was supported by the International Gold Corporation Limited (InterGold) and American Society for Metals (ASM). Literature searched through 1984. Part of the bibliographic search was provided by ASM. Professor Massalski is the ASM/NBS Data Program Editor-in-Chief for Binary Alloys and is also Co-Category Editor for binary gold alloys with Dr. Okamoto.

The Ag-Ir (Silver-Iridium) System

107.8682 192.22

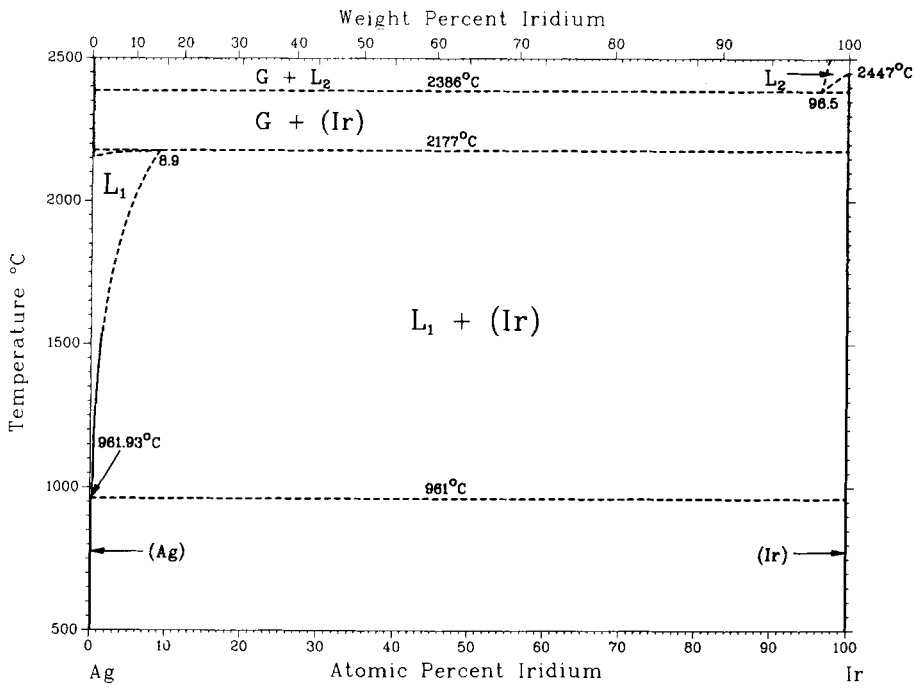
By I. Karakaya and W.T. Thompson
Royal Military College of Canada

Equilibrium Diagram

An equilibrium diagram based on experimental data is not available in the literature for the Ag-Ir system. Ir is insoluble in liquid Ag [00Ros]. Measurements of microhardness, electrical resistivity, thermo-emf, and microstructure indicate very small solid solubility of Ir in (Ag) and of Ag in (Ir) [59Rud]. The most dilute alloys (0.3 at.% Ir and 1.8 at.% Ag) have been reported to occur in the two-phase region. A change in microhardness of dilute alloys from the microhardness values for the pure elements indicate that the solid solubilities of Ir in (Ag) and of Ag in (Ir) are less than 0.3 at.% Ir and 1.8 at.% Ag, respectively.

Metallographic studies of Ag-Ir alloys did not show the presence of any intermediate phases [59Rud]. Differential thermal analysis of Ag-rich alloys indicated that the melting points of the alloys were very close to the melting point of pure Ag. An approximate phase diagram cal-

Fig. 1 Assessed Ag-Ir Phase Diagram (Approximate)



I. Karakaya and W.T. Thompson, 1986.

Table 1 Ag-Ir Crystal Structure and Lattice Parameter Data (25 °C)

Phase	Composition, at.% Ir	Pearson symbol	Space group	Strukturbericht designation	Prototype	Lattice parameter, (nm)	Reference
Ag(s)	0	*cF*4	*Fm*3*m*	*A*1	Cu	0.40861	[King1]
Ir(s)	100	*cF*4	*Fm*3*m*	*A*1	Cu	0.38391	[King1]

Table 2 Ag-Ir Thermodynamic Property Data

Thermodynamic properties of transformation with respect to liquid

$G^0(\text{Ag, L}) = 0$

$G^0(\text{Ir, L}) = 0$

$G^0(\text{Ag, fcc}) = -1\,218.86 - 90.7247\,T - 0.4799 \times 10^{-2}\,T^2 + 13.74\,T\ln T - 266\,500/T$

$G^0(\text{Ir, fcc}) = 1\,104.88 - 151.865\,T - 0.4002 \times 10^{-2}\,T^2 + 0.25167 \times 10^{-7}\,T^3 + 20.506\,T\ln T - 83\,050/T$

$G^0(\text{Ag, g}) = 281\,525 - 214.495\,T + 12.686\,T\ln T$

$G^0(\text{Ir, g}) = 652\,261 - 225.317\,T + 10.238\,T\ln T$

Estimated thermodynamic properties of liquid phase

$\Delta H(\text{L}) = 56\,500 X_{\text{Ag}} X_{\text{Ir}} + 2\,700 X_{\text{Ag}} X_{\text{Ir}}^2$

$S^{\text{ex}}(\text{L}) = 0$

Note: From [69Wag, 77Bar, Melt, 86Kar]. Values in J/mol and J/mol·K.

culated from estimated properties of dilute liquid alloys [86Kar] is shown in Fig. 1.

Crystal Structures and Lattice Parameters

The crystal structures and lattice parameters for pure solid Ag and Ir are given in Table 1.

Thermodynamic Modeling

[86Kar], in a previous evaluation, examined the empirical relationships between the limiting partial excess Gibbs functions and an interaction parameter (Z) for Ag–Group VIII binary liquids. Following this procedure, it can be estimated that for liquid Ag-Ir alloys (for which Z = 13.8):

$$G^{\text{ex}} = 56\,500\, X_{\text{Ag}} X_{\text{Ir}} + 2\,700\, X_{\text{Ag}} X_{\text{Ir}}^2 \qquad \text{(Eq 1)}$$

The approximate phase diagram shown in Fig. 1 was calculated for 1 atm hydrostatic pressure, assuming no mutual solid solubility and an ideal vapor phase. All of the data for computation are summarized in Table 2. From the phase diagram, it can be seen that the eutectic point at about 961 °C and 0.1 at.% Ir is in accord with the data of [59Rud] for the melting points of Ag-Ir alloys. The minimum solubility of Ir in liquid Ag, 0.1 at.% near the melting point of Ag, can be considered to be in accord with the data of [00Ros].

Cited References

00Ros: H. Rossler, "On the Behaviour of Rhodium in Noble Metal Alloys," *Chem. Ztg.*, *2*, 733-735 (1900) in German. (Equi Diagram; Experimental)

***59Rud:** A.A. Rudnitskii and V.P. Polyakova, "Silver-Iridium Alloys," *Russ. J. Inorg. Chem.*, *4*, 1158-1159 (1959). (Equi Diagram; Experimental)

69Wag: D.D. Wagman, W.H. Evans, V.B. Parker, I. Halow, S.M. Bailey, and R. Schumm, *Selected Values of Chemical Thermodynamic Properties,* National Bureau of Standards Series 270-4, 103, U.S. Department of Commerce, Washington (1969). (Thermo; Compilation)

77Bar: I. Barin, O. Knacke, and O. Kubaschewski, *Thermochemical Properties of Inorganic Substances (Supplement)*," 331, Springer-Verlag, Berlin (1977). (Thermo; Compilation)

86Kar: I. Karakaya and W.T. Thompson, "The Ag-Ru (Silver-Ruthenium) System," *Bull. Alloy Phase Diagrams*, in this issue (1986). (Thermo; Compilation)

*Indicates key paper.

Ag-Ir evaluation contributed by **I. Karakaya** and **W.T. Thompson**, Department of Chemistry and Chemical Engineering, Royal Military College of Canada, Kingston, Ontario K7L 2W3. The phase diagram was calculated with the F*A*C*T (Facility for the Analysis of Chemical Thermodynamics) data treatment center based in Montréal. The work was partially supported by a grant from the Canadian National Committee of the ASM/NBS Phase Diagram Project. Literature searched through 1985. Dr. Thompson is the ASM/NBS Data Program Co-Category Editor for binary silver systems.

The Ag-Os (Silver-Osmium) System

107.8682 190.2

By I. Karakaya and W.T. Thompson
Royal Military College of Canada

Equilibrium Diagram

Neither a phase diagram nor any other relevant information is available for the Ag-Os system. Following a computational procedure similar to that used in the development of the Ag-Ru [86Kar1] and Ag-Ir [86Kar2] phase diagrams, Fig. 1 is presented as a likely approximation for Ag-Os.

The approximate phase diagram for this system was calculated using a correlation of limiting partial excess Gibbs energies of Ag-Group VIII binary systems to the size effects and the electronic interactions.