determined the crystal structures of PaPt₃ and PaPt₅, respectively.

Cited References


87545. This work was supported by the Department of Energy through the Joint Program on Critical Compilations of Physical and Chemical Data, coordinated through the Office of Standard Reference Data (OSRD), National Institute of Standards and Technology. Literature searched through February 1987. Dr. Peterson is the ASM/NIST Data Program Category Editor for binary actinide alloys.

The C-Ni (Carbon-Nickel) System

By M. Singleton and P. Nash
Illinois Institute of Technology

The equilibrium phase diagram for the Ni-C (graphite) system is given in Fig. 1. The system consists of a simple eutectic with limited terminal solubility of C in fcc (Ni) and very limited (unresolvable in Fig.1) terminal solid solubility of Ni in C (graphite).

Equilibrium Diagram

The Ni-C phase diagram was reviewed by Hansen, Elliott, and 62Sami. The eutectic composition and temperature were investigated by several authors [50Ker, 67Ruh, 67Dou, 69Luc, 70Fil, 71Fil, 71Mir, 72Mat, 78Kau, 78Ryk, 81Ers]; published values range from 8.65 at.% C [67Rut] to 10 at.% C [81Ers], and 1314 °C [Hansen, Elliott] to 1335 ± 5 °C [72Mat]. In Fig. 1, the DTA data of [69Luc] have been used to fix the eutectic temperature at 1326.5 °C. The eutectic composition was taken from the liquation at fracture data of [67Rut]. Data points representing the composition and temperature values reported by other workers are also given in Fig. 1.

The solid solubility of C in (Ni) up to the eutectic temperature was investigated by [60Smi, 63Rao, 68Alc, 68Dun, 71Mir, 71Wad, 52La, 73Na, 73Tum, 74Lny, 75Schi, and 79Svo]. The (Ni) solvus shown in Fig. 1 is based primarily on the work of [73Na], who used a low-carbon combustion analysis technique to monitor the solubility in (Ni) of C introduced through the equilibration of foil samples in CH₄-H₂ gas mixtures of fixed composition. Data for the Ni-rich solidus are nonexistent. Therefore, the solidus in Fig. 1 has been constructed simply by interpolating between the melting point of pure fcc Ni (1455 °C) and the maximum solid solubility of C (graphite) in (Ni) reported by [Hansen] (2.7 at.% C).

The Ni-rich liquidus data points determined by [69Luc] using thermal analysis have been used to construct the corresponding boundary in Fig. 1. On the C-rich side of the system, liquidus data points are not available, so the phase boundary has been drawn to agree with the curve presented by [81Ers]. However, [81Ers] used 3827 °C as the melting point of graphite, whereas the value used in this evaluation is 3826 °C.

Metastable Phases

Although there are no stable carbides in the Ni-C (graphite) system, a metastable carbide (Ni₃C) can be produced. [67Ruh] found that splat quenching (~106 °C/s) a molten Ni-C alloy produced a highly supersaturated fcc phase, along with Ni₃C. Subsequent work by [81Ers] facilitated construction of a metastable equilibrium diagram that incorporated Ni₃C, along with a greatly extended solid solution of C fcc (Ni) (Fig. 2). Major inconsistencies at concentrations greater than 25 at.% C between the metastable diagrams presented by [81Ers] and [66Pon] have led to the omission of this portion of the diagram in Fig. 2.

Crystal Structures and Lattice Parameters

A summary of the structural data available for the Ni-C (graphite) system and the Ni-Ni₃C metastable system is given, along with references, in Tables 1 and 2. There is some reason to believe [Pearson1] that the hexagonal form reported for Ni₃C by [54Oke] is an interstitial solid solution of C in (Ni), as described by [49Ber].
Fig. 1 Ni-C (Graphite) Phase Diagram with Selected Data Points for the Ni-Rich Eutectic Composition and Temperature

Fig. 2 Ni-C (Graphite) and Metastable Ni-Ni3C Phase Diagram