FIG. 3. Brinell hardness numbers of the metallic alloy system InSb-Sn at 197°C.

Metallic indium antimonide is physically much harder than metallic tin.[24] Brinnel hardness numbers for InSb(II) and Sn(β) at $-196°C$ are 230 ± 30 and 46 ± 10 kg mm^{-2}, respectively. The Brinnel hardness numbers (at $-196°C$) for the metallic alloys InSbSn$_4$, InSbSn$_2$, and InSbSn lie between those of Sn(β) and InSb(II) (Fig. 3). Since Sn(β) and InSb(II) have essentially identical lattice parameters (Table I), the x-ray data alone are not sufficient proof that solid solution exists in these metastable tin-indium antimonide alloys. However, the variation of thermal stability cited above, the variation of the Brinnel hardness number (Fig. 3), and of the superconducting transition temperature[35] with the composition all indicate that solid solutions were formed.

VI. METALLIC INDIUM TELLURIDE

Our techniques for the preparation of metallic indium telluride, InTe(II), were similar to those used for the preparation of InSb(II). InTe(II) has been prepared (a) directly from solid InTe(I),[36-41] and (b) from samples cooled from 850°C at 30-kbar pressure.[42] The latter method should, according to the phase diagram of Banus et al.,[40] yield InTe(II) directly from

[35] B. R. Tittmann, A. J. Darnell, H. E. Bömmel, and W. F. Libby, Science 139, 1301 (1963).
[36] M. D. Banus, J. A. Kafalas, R. E. Hanneman, and H. C. Gatos, Solid State Research Report, Lincoln Laboratory, MIT, No. 3, 1962 (unpublished).
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[41] C. B. Sclar, L. C. Carrison, and C. M. Schwartz, Science 143, 352 (1964).
[42] H. E. Bömmel, Bull. Am. Phys. Soc. 8, 623 (1963).

liquid indium telluride. Moreover, it would seem less likely to contain InTe(I) as an impurity in view of the difficulty experienced in carrying the solid (I) → solid (II) reaction to completion. In both methods of preparation InTe(I), once obtained, was cooled to $-196°C$ then brought to atmospheric pressure. Metallic InTe(II) was stored at $-196°C$ since it reverts slowly to InTe(I) at room temperature.[40] All other elements, detectable by spectrographic analysis, amounted to less than 0.03%.

A. Properties

1. Structure

The tetragonal form of normal InTe collapses at high pressure and temperature to a NaCl (B_1)-type structure[40] which by suitable quenching can be brought to atmospheric pressure in a metastable state. Subsequent to our first report[39] we have been able to obtain reflections for the first three odd [hkl] indices of InTe(II). Only the first of the odd indices, hkl [111], was observed by the Bragg-Brentano technique at 25°C. However, reflections attributed to hkl (311) and (331) were observed at $-196°C$ due to enhancement of the intensity of the diffracted beam at this lower temperature. Geller et al.[43] report odd-index reflected for [111], [311], and [311] in NaCl—like In$_{0.82}$ Te.

The lattice constants for InTe(II) are given in

TABLE II. Lattice spacings and lattice parameters of InTe(II) at atmospheric pressure.

hkl	25°C d_{hkl}(Å)	$-196°C$ d_{hkl}(Å)
111	3.570	3.549
200	3.091	3.086
220	2.185	2.177
311	...	1.856
222	1.784	1.776
400	1.544	1.538
331	...	1.411
420	1.381	1.375
422	1.261	1.256
511	...	...
440	1.093	1.087
531	...	...
600	1.0295	1.0244
620	0.97626	0.97192
533	...	...
622	0.93134	0.92642
444	0.89188	0.88762
711	...	...
640	0.85633	0.85253
a_0(Å) (Calculated from last 5 lines)	6.177 ± 0.002	6.147 ± 0.002

Table II. The diffraction angles (2θ) of InTe(II) were measured relative to the diffraction angles of NaCl yielded by a small quantity of NaCl added to the

[43] S. Geller, A. Jayaraman, and G. W. Hull, Jr., Appl. Phys. Letters 4, 35 (1964).