Structure of Liquid Pb-Bi Alloys by X-ray Diffraction

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X-ray diffraction measurements were made at temperatures about 50°C above liquidus in the Pb-Bi system. Three partial structure factors $S_{ij}(Q)$ were evaluated from the observed X-ray intensities assuming that each $S_{ij}(Q)$ is independent on the relative abundance of the constituent elements in the alloys. The partial reduced distribution functions $G_{ij}(r)$ were also calculated. The functions $S_{ij}(Q)$ and $G_{ij}(r)$ have maxima which lie between those of the pure elements. The radii of the first coordination sphere show a linear dependence on the concentration as expected from random distribution of the atoms in liquid Pb-Bi alloys. A comparison was made between the partial and total structure factors obtained in this work and those calculated from the hard sphere model. Adequate agreement was obtained on the first peak, but good agreement of the damping behaviour and phase was not necessarily found.

Shock Compression of Titanium Monoxide up to 600 kbar

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Hugoniot data were obtained for titanium monoxide TiO_x ($x=0.84$, 1.06, and 1.28), up to about 600 kbar by shock wave compression. A small explosive lens system was used for the purpose of generating plane shock waves. Shock velocities and free surface velocities were measured by means of an electric pin-contactor method; the shock state was computed on the basis of free surface approximation. Regardless of the values of x, the compounds TiO_x were shown to be extremely incompressible even in this ultrahigh pressure region; no evidence was found for significant filling of vacancies.

X-ray Diffraction Study of Static Distortion of the Host Zirconium Lattice in Interstitial Zr-O Solid Solutions

Shinya HASHIMOTO

Static distortions of the host zirconium lattice as caused by the interstitial oxygen atoms have been determined by X-ray diffraction for Zr–23.6 and 24.8 at.%O alloys. The arrangement of oxygen atoms in the former alloy is specified by the ZrO_x or ABC-type stacking structure and that in the latter by a statistical sequence of two kinds of oxygen layer, i.e. single A and double AB layers. The present work has proved that each zirconium atom shifts toward the adjacent oxygen atoms and the magnitude of the displacement is about 0.04 Å for both the alloys. The anomalous dependence of the lattice constants on oxygen concentration

is qualitatively explained by the local contraction in the c plane.

X-Ray Photoemission Study of the Liquid Au-Sn Alloy

T. ICHIKAWA

X-ray photoemission spectra of the core and valence states of liquid and solid Au-Sn alloys have been measured. The composition dependence of binding energies of the Au $4f_{5/2, 7/2}$ peaks suggests that the liquid Sn-rich alloy has a fairly fixed type of local atomic environment around Au atoms different from that in the solid Sn-rich alloy. Estimated composition indicates that the surface is enriched in Sn component on an average.

Constitution of the Magnesium-Indium System near the Composition of Mg_3In and Phase Transition of β_1 Phase

Yousuke WATANABE

The phase diagram of the Mg-In system was re-examined, as there was some uncertainty as to the phase transition of β_1 phase in the literature. It was found that the direct transition of β_1 to β' phase is prevented by the two phase region in the whole composition range investigated. In addition to this, location of Mg_5In_2 phase (β_3 phase) in the diagram was for the first time made clear. β_3 phase is stable only below 210°C and decomposes into β' and β_2 phases above this temperature. The confirmation of the crystal structure of β_1 phase was also done on single crystal electron diffraction patterns. Mg_3In changes its structure from ordered 12R to disordered f.c.c. through ordered 3R with increasing temperature. The transformation energy associated with the change in the stacking sequence (12R → 3R) and that associated with the order-disorder phase change were estimated by specific heat measurements to be ~ 120 cal/mole and ~ 340 cal/mole, respectively.

Composition Dependence of the Long-Period Layer Stacking Sequence in the Structure of the Ternary Alloy $Mg_3In_{1-x}Cd_x$

Yousuke WATANABE

The effect of the replacement of some fraction of the indium atoms with cadmium atoms on the structural stability of the long-period layer stacking sequence in Mg_3In has been studied by means of X-ray and electron diffraction experiments. The observed changes in electron diffraction patterns can be described by Kakinoki's equation and suggests that when the cadmium content is