Effective Interionic Pair Potentials and Properties for Liquid Sodium and Potassium

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Effective interionic pair potentials for liquid sodium and potassium have been derived from recent X-ray diffraction data using the Born-Green and Percus-Yevick equations. The results, in good agreement with pseudopotential or molecular dynamics calculations, were obtained in the case of the Born-Green equation.

Self-diffusion coefficients of these metals were calculated from the Born-Green pair potential and the pair correlation function using the kinetic theory of fluids. The contributions of the hard, soft and cross-effect between the hard and soft forces to the self-diffusion coefficient were discussed. In addition, viscosity coefficients and surface tensions were calculated. In all cases, adequate agreement with experimental data was obtained.

Partial Structure Factors of Liquid Na-K and Al-Mg Alloys

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Three partial structure factors $S_{ij}(Q)$ have been evaluated from the scattered X-ray intensities of liquid Na-K and Al-Mg alloys assuming that the $S_{ij}(Q)$ are independent of the relative abundance of the respective elements in the alloys. The functions $S_{ii}(Q)$ and $S_{jj}(Q)$ and the reduced radial distribution functions $G_{ii}(r)$ and $G_{jj}(r)$ obtained in this work are very similar to those observed in the respective pure liquid metals. In both cases, $S_{ij}(Q)$ and $G_{ij}(r)$ have maxima which lie in between those of the pure elements. From these results, liquid Na-K and Al-Mg alloys are interpreted as random mixing fluids.

A comparison between the partial structure factors obtained in this work and those calculated from the hard sphere model was made. Adequate agreement was obtained on the low angle side of the first peak, but agreement on the whole pattern is not necessarily found. The electrical resistivity was calculated using Faber-Ziman's theory and compared with experimental data.

Interionic Potentials in Liquid Metals Including Liquid Noble and Transition Metals

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The Born-Green equation has been analyzed numerically to derive the effective interionic pair potentials from the structural data observed by X-ray or neutron diffraction experiments for liquid metals (Mg, Zn, Hg, Al, Ga, In, Tl, Sn, Pb, Sb, Bi), noble metals (Cu, Ag, Au), and transition metals (Fe, Ni) using a linearized simultaneous equation method. In all cases the potentials were found to be insensitive to temperature and to have long-ranged oscillations. But the damping behaviour

of the oscillations for liquid Sb and Bi remarkably deviates from that of the usual metals such as liquid Na. For most metals, the wavelengths of oscillations observed in this work are in agreement with those expected from the electron theory of metals. The viscosity coefficient and surface tension were calculated. Adequate agreement with experiments was found.

Magnetic Properties of $Sm_2(Co_{1-x}Al_x)_{17}$

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Magnetic properties of $Sm_2(Co_{1-x}Al_x)_{17}$ powders with $0 \le x \le 0.12$ have been investigated at room temperature. The crystal structure of these alloys is of the rhombohedral Th_2Zn_{17} type. The lattice constants a and c were found to increase monotonically with x. The magnetization curves of aligned-powder pellets shows that the decrease of the saturation moment is stronger than that expected for a model of simple dilution of Co moments with non-magnetic Al. In the whole range of x studied these alloys have a magnetically easy c-axis. Approximate values of the anisotropy field and the anisotropy constant were estimated from the magnetization curves. The former increases slightly with x and the latter decreases. Curie temperatures of the alloys were determined by the magnetization-temperature curve measured with a magnetic balance.

Thermal Expansion of Siliconated Pyrolytic Carbon

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The lattice and bulk thermal expansions perpendicular to the layer plane of siliconated pyrolytic carbon, PC(Si), produced by pyrolyzing a mixture of propane gas and silicon tetrachloride vapour at the deposition temperatures of 1440 to 2025°C, have been measured over the temperature ranges 20 to 550°C and 20 to 960°C, respectively. The expansion behaviours of PC(Si) are related to the density and the degree of preferred orientation of crystallites, as is the case for pyrolytic carbon without silicon "PC". At a deposition temperature of about 1700°C, the bulk thermal expansion coefficient of PC(Si) is about three times as large as that of PC.

Phenomenological Dislocation Theory on Pre-Ductile-Fracture Process

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The strain hardening coefficient n and ultimate strain ε_u and their correlation have been investigated mainly as phenomena. In this investigation, those parameters were analysed from phenomenological dislocation theory. The strain hardening coefficient was interpreted by the product of two terms in which one is the contribution of dislocation density to flow stress and the other is dislocation