Annotation

The book considers experimental techniques in the study of thermal (density, *PVTx*), caloric (heat capacity, $C_V VTx$), and transport (thermal conductivity, λPTx) properties of aqueous systems (light and heavy water, their mixtures, aqueous salt, aqueous hydrocarbon, and aqueous alcohol solutions) in a broad range of independent thermodynamic variables (*PVT*), including near-critical and supercritical regions. The experimental thermodynamic (*PVT*), ($C_V VT$), and transport (λPT) properties results for pure light and heavy water, hydrocarbons, and methanol, and the (*PVTx*), ($C_V VTx$), and (λPTx) results for binary aqueous salt, aqueous hydrocarbon, and aqueous methanol solutions at high temperatures and high pressures obtained in the Thermopysical Division of the Dagestan Scientific Center of the Russian Academy of Sciences are presented and evaluated.

A detailed analysis of the modern theoretical crossover equations of state for the prediction of thermodynamic properties of aqueous systems in, and beyond, the critical region is given. All available sources of data for the *PVTx*, $C_V VTx$, and λPTx of aqueous systems have been collected, evaluated, corrected, and converted to the ITS-90 temperature scale. Critical analyses are presented as to the uncertainty of each data source, along with comparisons with other sources. The most reliable (*PVTx*, $C_V VTx$, and λPTx) data for light and heavy water, and aqueous systems are selected and recommended for scientific and technological applications.

Useful information is given for *PVTx* measurements for pure light and heavy water, pure hydrocarbons, aqueous hydrocarbon and aqueous salt solutions in the near-critical and supercritical regions, and on the coexistence curve. The analyses of the avaliable various types (multiparameter, MBWR, fundamental, IAPWS-95 formulation, virial, scaling, and crossover) equations of state for pure components, aqueous hydrocarbon, and aqueous salt solutions are presented.

A brief review of the calorimetric methods for determining the isochoric heat capacity of light and heavy water, their mixtures, aqueous hydrocarbon, aqueous salt, and aqueous alcohol solutions in near-critical and supercritical conditions is included. Detailed comparisons of various experimental data sets for isochoric heat capacity with crossover equations of state and IAPWS-95 and IAPWS-85 for light and heavy water, their mixtures, and aqueous salt solutions are also presented.

The thermal conductivity data sources for light and heavy water, and aqueous salt solutions at high temperatures and high pressures are reviewed, including brief descriptions of the methodology, known sources of uncertainties, boundaries of study, and uncertainty estimates for different thermodynamic states. The various correlation and prediction techniques for thermal conductivity of the aqueous salt solutions are discussed. All of the avaliable experimental data sets for thermal conductivity of light and heavy water, and 25 aqueous salt solutions were critically analyzed, and their reliability and consistency estimated; selected data sets are recommended on the bases of detailed comparisons with the IAPWS-98 formulation for light and heavy water, and various correlation equations and prediction techniques for salt solutions.

We have presented tables of original extended experimental data ($PVTx$, $C_V VTx$, and λPTx) for pure light and heavy water, their mixtures, aqueous salt solutions, aqueous hydrocarbon mixtures, and aqueous alcohol solutions at high temperatures and high pressures, including two- and one-phase regions, near-critical and supercritical regions, and properties at saturation.