Preface

Because of the rapid development of various branches of engineering, an ever growing interest in obtaining information on the thermodynamic properties of numerous pure substances and mixtures with which researchers and practical engineers deal when solving various scientific and application problems has been observed in the last years. No one of the science or engineering projects can be implemented without data on the properties of materials involved in particular processes. Modern physics only rarely makes it possible to calculate substances' properties. Therefore, it is experiment that is the principal source of information for the great majority of properties of most common substances and materials.

For many years, a vast amount of experimental data on the thermodynamic properties of gases, liquids, and their mixtures has been obtained in various research laboratories over the world. In this sea of data, the results of the authors of this country hold a firm place. Unfortunately, they are frequently represented in foreign editions insufficiently, because significant part of these data has been published in sources that are difficult to reach for foreign readers.

This book corrects the situation to a certain degree. The book considers various methods of experimental study of thermal and caloric properties of pure substances and binary mixtures in wide ranges of the variation of independent variables, including the near-critical region. Primary experimental (p, V, T), (C_V, V, T), and (p_s, T_s) results for pure substances and (p, V, T, x), (C_V, V, T, x), and (p_s, T_s, x) results for binary systems obtained in a number of laboratories of the former USSR are presented and evaluated.

It is well known that to develop new methods and improve the existing techniques of theoretical computation of determining thermodynamic properties of substances, reliable experimental data are required; it is due to the existence of such data that practical methods of the use of equations of state have been developed extensively in the last two decades. Here, the formal theory that relates the macroscopic nature of the virial coefficients and the microscopic nature of molecular forces is most relevant. The equations of state considered in this book are, on the one hand, a kind of instrument for obtaining information on the

intermolecular forces and, on the other hand, are a basis for calculating thermodynamic properties of pure substances and binary mixtures.

With approaching to the critical point, the classical equations of state lack their efficiency, because they cannot ensure universality in describing the behavior of substances in the critical region. In this region, the details of interparticle interaction become insignificant and the behavior of the system is determined by anomalous fluctuations that involve a large number of molecules. The behavior of fluctuations has for years been described phenomenologically in terms of the modern theory of critical and crossover phenomena for pure substances and binary mixtures. These problems are dealt with in numerous publications; so, we here only give a brief analysis of the last achievements in this field. The problems of crossover description of the behavior of thermodynamic functions of binary systems near the critical line are considered in more detail.

We hope that the results represented in this book will be useful to a wide circle of researchers and practionists working in various fields of science and technology.

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