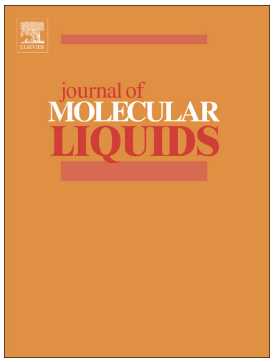

Surprising thermodynamic properties of alcohols and water on their coexistence curves

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Surprising thermodynamic properties of alcohols and water on their coexistence curves

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The thermodynamic properties of water and alcohols of the methanol series on their coexistence curves (CCs) are analyzed. The main attention is focused on the behavior of their specific volumes per molecule and the evaporation heats. We show that the special normalization of these quantities and standard normalization of temperature leads to the similarity of their temperature dependencies on their CCs. And what is more, they are similar to the temperature dependencies for argon. It means that the behavior of the specific volume and the evaporation heat are determined by the averaged interparticle potentials which have the argon-like structure. Small deviations from argon-like dependence are carefully studied. We suppose that these small deviations are caused by the weak angular correlations created by H-bond interactions and should be connected with the main characteristics of H-bond network that is the averaged number of H-bonds per molecule. A method for determination of the last is developed.

Keywords: H-bonds, argon, water, alcohols of the methanol series

To 80-th anniversary of known Russian physico-chemist George Malenkov is dedicated

Introduction

As it seems to be, all the thermodynamic properties of water and alcohols of methanol series differ essentially from each other as well as from the thermodynamic properties of argon. Such a belief was formed because of the following reasons: 1) the properties of argon are determined by spherically-symmetrical potential including the repulsive part characteristic for soft spheres and the dispersive part; 2) the main properties of water and alcohols are determined by H-bonds leading to strong angular dependence of intermolecular potentials;

3) the H-bonds form the spatially ordered H-bond network in water while in alcohols they form only linear chains or closed loops. The situation does not become simpler if we take into account the electrostatic nature of H-bonds [1-4]. Besides, in order to explain some properties of alcohols the hydrophobic interactions are taken into account [5].