

Modelling the Viscosity of Fluid Mixtures from Gases to Dense Liquids - VW Method

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There is a considerable need for accurate and reliable information on the viscosities of fluid mixtures that can only be obtained by the development of predictive methods, as the plethora of possible mixtures and of conditions of interest precludes a purely experimental approach. The development of molecular-based approaches has been hampered by lack of versatile theory. The problem is especially acute for asymmetric mixtures involving large, non-spherical, molecules. One of the methods that has gone a long way in addressing some of these issues is the VW method [1]. Recently, this method has been extended to account for long, chain-like molecules [2,3]. The resulting VW-chain method was specifically designed to accurately predict the viscosity of liquids by making use of the fact that at liquid-like densities the collision rate is high. As a consequence the VW-chain method does not have the right zero-density limiting behaviour and cannot be used at gas-like densities. In order to overcome this issue we combine the VW and VW-chain methods by introducing an effective chain length. This parameter is obtained from the properties of the pure fluids based on simple physical arguments. At high densities, it is equal to the chain length used in the VW-chain approach, while at low densities it goes to unity, thus reducing to the original VW method. We illustrate the predictive power of the new VW method by validating it against the experimental data at intermediate densities and show that it outperforms both the original VW and VW-chain methods.

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