Prediction of Natural Gas Mixtures Properties from Cubic and Molecular-Based Equations of State

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Natural gases are among the cleanest, safest, and most useful fuels and feed stocks. The economic importance of natural gas imposes a need for accurate knowledge of its thermodynamic properties over a wide range of pressures and temperatures to optimize its production, transportation, and utilization. The composition of natural gases can vary widely depending upon the reservoir from which the fluid comes. Hence, it is almost impossible, because of economic and time constraints, to measure all of the properties for all of the possible mixtures over the wide temperature and pressure ranges required; reliable models are essential.

In this work, we have predicted properties for several synthetic natural gas mixtures using cubic and molecular based equations of state. These models play a pivotal role in the thermodynamic property modeling of complex mixtures and in chemical engineering design. Thus, they are the most common option for the study of properties of fluid multicomponent mixtures. While cubic equations of state are the usual choice in the chemical and gas industries, modern molecular based equations, whose theoretical background is stronger, are used rarely, and systematic studies of their ability to predict properties of complex mixtures is lacking. We have used simple, monoparameteric van der Waals mixing rules with binary interaction parameters derived from correlations of experimental binary data over wide pressure and temperature ranges.

The aim of this work is to determine which equation of state is most accurate for the property predictions for these kinds of systems, and to test if the introduction of additional complexity in the modeling is justified.