

## **Polarizability Measurements of (Hydrogen + Carbon Dioxide) Mixtures using Microwave Cavity Technology – Examination of Polarizability Mixing Rules**

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The accurate description of the thermodynamic behavior of multicomponent gas mixtures is crucial for many industrial applications. Currently, available thermodynamic property models such as empirical multiparameter equations of state are able to predict the phase behavior of fluid mixtures, however, the lack of accurate experimental data often leads to erroneous vapor-liquid equilibrium (VLE) calculations. A new method currently under study is based on microwave cavity technology and exhibits the potential of accurate and fast investigation of the complete phase properties of binary fluid mixtures. Here, the precise knowledge of the mixture polarizability plays a key role as it is inherent part of the Harvey and Prausnitz mixing rule. This mathematical approach is based on the pure component's molar polarizability and, therefore, strongly depending on its accurate knowledge. Against this background, molar polarizability measurements of pure hydrogen were carried out over a temperature range from (248 to 303) K with pressures up to 8 MPa using a microwave re-entrant cavity resonator and compared with available literature data. Furthermore, measurements of two (hydrogen + carbon dioxide) mixtures with hydrogen mole fractions of 0.05 and 0.25 were conducted within the same  $p$ ,  $T$  range. Here, we present the determination of the mixture molar polarizability based on (1) the measured mixture dielectric permittivity and its density calculated with an EOS and (2) the measured mixture dielectric permittivity combined with hydrogen's molar polarizability retrieved from pure hydrogen measurements. By comparison of both methods, we discuss if the mixing rule itself, as assumed thus far, or the quality and availability of experimental pure compounds data is the reason of inaccurate VLE determination when using microwave technology.