Determination of Phase Equilibria using a New Technique Based on a Resonant Cylindrical Cavity

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High-pressure phase equilibrium data are often complex and difficult to predict and it is necessary to obtain some experimental data. The electric permittivity or dielectric constant is a physical property that can be defined as the electric polarization acquired by the molecules of a substance as a result of the induction generated by an electromagnetic field. It is an extensive property which depends on temperature and pressure ε(p,T).Based on this property has been developed a measurement technique which consists of a cylindrical resonant cavity that works in the microwave band; a sapphire tube with the sample is located inside this cavity. The resonant modes of cylindrical cavity depend on the electrical properties of the sample. For example, a liquid sample is maintained at constant temperature and the pressure is decreasing until the first bubble occurs, this phase transition presents a discontinuity in the electric permittivity and therefore in the resonant modes of the cavity. With the reverse procedure it is possible to measure the dew point. With this technique, the equilibrium data of fluid mixtures at high pressure are measured applying the synthetic method. This technique can be an alternative to the traditional visual synthetic method. The technique is checked by measuring the system CO_2-methanol which is widely referred to in the literature.