Measurement of the Speed of Sound for Mixtures of Carbon Dioxide with Methane for the Thermodynamic Characterization of Non-Conventional Energy Gases

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Experimental characterization of the thermodynamic behavior of gas binary mixtures containing components of fuel gases is of great importance due to the actual lack of reliable data of thermodynamic properties of mixtures. These data are essential not only for the improvement and test of the current reference equation of state for natural gases and related mixtures, GERG-2008, but also for the indirect determination of other thermophysical properties. In this work speed of sound measurements of mixtures of carbon dioxide with methane are presented as a contribution to the research project EMRP ENG01 of the European Metrology Research Program, in the field of characterization of energy gases. Experimental speed of sound data is used for the determination of the isobaric heat capacity of these mixtures. Accurate speed of sound measurements for three binary mixtures of carbon dioxide with methane (x_{CO2} = 0.20, 0.40, 0.60) were performed at temperatures between 250 K and 400 K, and pressures up to 20 MPa. The measuring technique used, a spherical gas resonator, is one of the state of the art methods for speed of sound measurement and isobaric heat capacity determination. The final objective of the project is a complete thermodynamic characterization of non-conventional energy gases which will enable the "inter-changeability" of energy gases so that gaseous fuels from non-conventional sources can access conventional natural gas grids.