Experimental Determination of (P, P, T) Data for Mixtures of Carbon Dioxide with Methane for Indirect Calorific Value Determination of Non-Conventional Energy Gases

María E. Mondéjar [S], César R. Chamorro [C], José J. Segovia and Miguel A. Villamañán
Universidad de Valladolid, Research Group TERMOCAL. Dpto. IEF, Valladolid, Spain
cescha@eis.uva.es

Teresa E. Fernández and Dolores del Campo
Centro Español de Metrología, CEM, Área de Temperatura, Tres Cantos, Madrid, Spain

Frederique Haloua
Laboratoire National de Métrologie et d'essais, LNE, Paris, France

Experimental characterization of the thermodynamic behavior of gas binary mixtures containing components of fuel gases is of great importance due to the proved 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 properties. In this work density 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 density data will be used for the indirect determination of calorific value measurements of non-conventional energy gases. Therefore, accurate density 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, using a single sinker densimeter with magnetic suspension coupling, which is one of the state of the art methods for density determination over wide ranges of temperature and pressure. Experimental densities were compared with the GERG-2008 equation of state and with the experimental data reported by other authors for similar mixtures. Despite results which showed consistence between all experimental data in the working range, large deviations from the equation of state observed at low temperatures suggested the possibility of higher uncertainties of the GERG model in the low temperature range.