

Speed of Sound Measurements of Methane with Helium

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Helium is a minority component of natural gas but in some fields, it can make up 10 %. In addition, commercial helium is mostly extracted from natural gas. For the calculation of thermodynamic properties of natural gas, the GERG-2008 equation of state was chosen as standard. However, the quality and the availability of experimental data limit the achievable accuracy of the equation. As regards the fundamentals of the GERG-2008 wide-range equation of state, no suitable data were available for many mixtures containing secondary natural gas components such as methane + helium mixtures. Some density measurements were performed in our laboratory and now, new measurements of speeds of sound are reported in this work. A spherical resonator is used for the measurements of the speed of sound. It is a spherical cavity, with an internal radius of 40 mm and thickness of 10 mm, which consists of two different hemispheres fixed by electron beam welding, fabricated from grade 321 austenitic stainless steel and manufactured at Imperial College. It is equipped with two capsule-type platinum resistance thermometers which provide a standard uncertainty in temperature measurements of ± 1 mK at 273.16 K. The pressure is measured by means of two resonant quartz-crystal manometers for the pressure ranges (0 to 2) MPa and (1 to 20) MPa with a relative standard uncertainty of $\pm 1 \cdot 10^{-4}$. The total uncertainty of the speed of sound is not worse than 0.02 %. The results are also compared with the GERG-2008 equation of state.

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