Measurement of the Viscosity of (Hydrogen + Methane) and (Hydrogen + Carbon Dioxide) Gas Mixtures

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Hydrogen gains increasingly more importance as clean fuel and basic material for green chemical processes since the world seeks for measures to reduce carbon dioxide emissions. Transportation of hydrogen-rich mixtures on the one hand and design of hydrogen-generating processes on the other require an accurate prediction of thermophysical properties, such as the dynamic viscosity. However, currently existing models are not validated for hydrogen-rich mixtures and show large deviations to experimental data especially in the high-pressure range, due to a limited data base. To meet the demand for highly accurate experimental data, the viscosity of (hydrogen + methane) and (hydrogen + carbon dioxide) binary mixtures was measured in the thermodynamic laboratory at Ruhr University Bochum, Germany. The measurements were carried out utilizing a low-pressure viscometer over the temperature range of (253.15 to 473.15) K and pressures up to 2 MPa and a high-pressure viscometer over the temperature range of (253.15 to 473.15) K and pressures up to 15 MPa. With both apparatuses the viscosity was determined via deceleration of a vertically levitating rotating-body due to the fluid friction. The relative expanded uncertainty for the binary mixtures does not exceed 0.4% for pressures up to 2 MPa and 0.7% for pressures up to 15 MPa.