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PVTxy properties of CO_2 mixtures relevant for CO_2 capture, transport and storage: Review of available experimental data and theoretical models

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ABSTRACT

The knowledge about pressure–volume–temperature–composition (PVTxy) properties plays an important role in the design and operation of many processes involved in CO_2 capture and storage (CCS) systems. A literature survey was conducted on both the available experimental data and the theoretical models associated with the thermodynamic properties of CO_2 mixtures within the operation window of CCS. Some gaps were identified between available experimental data and requirements of the system design and operation. The major concerns are: for the vapour–liquid equilibrium, there are no data about CO_2/COS and few data about the CO_2/N_2O_4 mixture. For the volume property, there are no published experimental data for CO_2/O_2, CO_2/CO, CO_2/N_2O_4, CO_2/COS and CO_2/NH_3 and the liquid volume of CO_2/H_2. The experimental data available for multi-component CO_2 mixtures are also scarce. Many equations of state are available for thermodynamic calculations of CO_2 mixtures. The cubic equations of state have the simplest structure and are capable of giving reasonable results for the PVTxy properties. More complex equations of state such as Lee–Kesler, SAFT and GERG typically give better results for the volume property, but not necessarily for the vapour–liquid equilibrium. None of the equations of state evaluated in the literature show any clear advantage in CCS applications for the calculation of all PVTxy properties. A reference equation of state for CCS should, thus, be a future goal.

Contents

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