Experimental study and phase equilibrium modeling of systems containing acid gas and glycol

In this work, we study phase equilibria of systems containing acid gases and glycols. The acid gases include carbonyl sulfide (COS), hydrogen sulfide (H$_2$S), and carbon dioxide (CO$_2$) while glycols include monoethylene glycol (MEG), diethylene glycol (DEG), and triethylene glycol (TEG). A brief literature survey on the solubility of the acid gases and hydrocarbons in glycols is presented. New experimental solubility data mainly for COS and some limited data for H$_2$S in glycols from 276 to 333K and at elevated pressures are reported. Experimental measurements have been carried out using the “static-synthetic” method. The reliability and repeatability of the experimental work are demonstrated. The experimental solubility data for COS and glycols, from this work, and those for H$_2$S and CO$_2$ from the literature are modeled using the cubic-plus-association (CPA) equation of state (EoS). CPA parameters for pure components and binary systems are reported. Satisfactory correlations have been achieved using temperature-independent interaction parameters. Various modeling strategies and alternatives using CPA are tested and the results are critically evaluated. The variations and trends in the values of binary interaction parameters are discussed for the different systems studied.
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Abbreviations: BIP, binary interaction parameters; EoS, equation of state; CPA, cubic-plus-association; CR, combining rule; DEG, diethylene glycol; GPA, Gas Processors Association; MEG, monoethylene glycol; mCR, modified combining rules; RD, relative deviation; RAAD, relative absolute average deviation; SAFT, statistical association fluid theory; SRK, Soave–Redlich–Kwong EoS; TEG, triethylene glycol; TeEG, tetraethylene glycol; TPT, thermodynamic perturbation theory; VLE, vapor–liquid equilibria.

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