



Determination of Thermodynamic Properties in Complex Scale Systems

Experimental and modelling efforts to improve estimation of scale solubility in brines

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Determination of Thermodynamic Properties in Complex Scale Systems

Experimental and modelling efforts to improve estimation of scale solubility in brines

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Mineral scaling is a critical problem in wells and in top-site facilities. The deposited scale is typically very stable in terms of chemical and thermal properties, which makes it extremely difficult to remove once it has precipitated. Preventing solid deposition is both technically and economically more efficient than dealing with it after its formation. Therefore, accurate estimates of solubility in brines are crucial to approach the scaling problem.

Solubility calculations rely on a thermodynamic model to determine activities of each species present in the multicomponent electrolyte mixture (brine). In addition to the activities, chemical equilibrium constants must be estimated for each possible precipitate, given the composition of the brine. Activities and equilibrium constants are then used to determine the saturation index of each salt. This index can be used as a guide to avoid operation under conditions in which precipitation is possible. These models are typically fitted to experimental data, such as solid-liquid equilibrium measurements. In this sense, the models are only as good as their input data.

The goal of this project is to enhance the accuracy and range of solubility calculation in brines. The expected outcome is a newly parameterized version of the Extended UNIQUAC model that can overcome current calculation limitations in terms of temperature, pressure, and composition ranges. The new parameter set should also include additional species which were not considered before, if sufficient data is available. This work entailed a thorough literature review to assess the available information. The findings from this search showed that the available data are scarce and conflicting. This means that the current information does not allow for an unequivocal description of the saturation limits. The result from these analyses were used to establish experimental campaigns that can fill the knowledge gaps related to these systems.

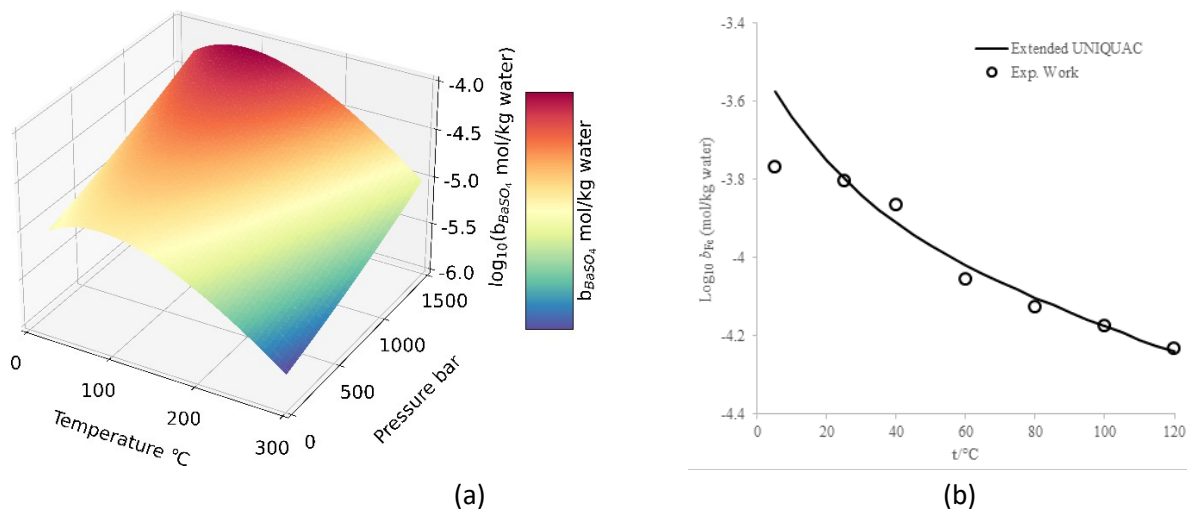


Figure 1. (a) Barium sulphate and (b) iron carbonate solubility in water estimated by the ExtendedUNIQUAC.