GeoTHERM
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Tiefe Geothermie

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Deep geothermal energy

Relevance of accurate estimation of the geothermal fluid's PVT properties based on a practical numerical tool

Relevanz einer genauen Schätzung der PVT-Eigenschaften des geothermischen Fluids auf der Grundlage eines praktischen numerischen Tools

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Accurate prediction of phase behavior and PVT properties are essential in geothermal reservoir and production engineering, not only for systems with high concentrations of salts/solids and non-condensable gases (NCGs) but also for low solid concentrations. Over the years, half empirical equations of state (EoS) models, such as Peng-Robinson and Soave-Redlich-Kwong as well as empirical correlations have been developed, refined, and adapted to meet the evolving needs of the hydrocarbon industry, and more recently, the CCS (Carbon Capture and Storage) and geothermal sectors. Recent experimental studies on geothermal brines under varying temperatures and pressures have focused on understanding the impact of salt and NCG content on phase behavior and calculating their intrinsic and extrinsic properties.

This study explores the application of different EoS models, integrated with empirical correlations specifically tailored to predict the phase behavior of geothermal fluids. Besides, the available experimental studies conducted under typical geothermal reservoir and wellbore thermodynamic conditions are studied. In this context, the effect of varying pressure-temperature on aqueous/gaseous geothermal fluid's PVT properties and component concentrations are investigated. The use of experimental correlations giving the solubility and related properties are found more convenient for this purpose at the pressure-temperature-concentration ranges that are typical for geothermal reservoirs. A PVT package to calculate the thermodynamic properties which are crucial for geothermal projects such as density, enthalpy, heat capacity, and critical properties using state of the art empirical correlations is presented and discussed. The effects of salt content on the thermodynamic properties of geothermal fluids are added into the PVT package. Then, the use of the PVT package for different purposes is evaluated incorporating it into generic models of geothermal systems and flow in the wellbore. Additionally, the potential influence of dissolved solid and gas concentrations on the production performance of geothermal wells is examined, also offering insights into scaling and corrosion issues as well as remediation measures.