نخستین سمینار شیمی کاربردی ایران
(1IACS)
۲-۱ شهریور ۱۳۹۵، دانشکده شیمی، دانشگاه تبریز

PREDICTIONS OF FLUIDS PROPERTIES AND PHASE BEHAVIOUR IN CRUDE OIL AND NATURAL GAS PRODUCTION, PROCESSING AND TRANSPORTATION

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Abstract: *Predicting the properties of hydrocarbon fluids and phase behaviour is a critical factor in the safe and efficient design of crude oil and natural gas production, processing and transportation facilities. The optimal design of such facilities is highly dependent on the state of the hydrocarbon fluids constituents. Process simulation tools are widely employed to predict the behaviour of the fluids under the operations of oil and gas production and processing systems. However, the existing thermodynamic models in many cases lack the capability to accurately predict the behaviour of the fluids under some certain conditions. The importance of such predictions becomes crucially high when the modelling is completed under transient conditions. In order to perform an accurate dynamic simulation, the tuning of existing thermodynamic models may become necessary. Using a tuned thermodynamic model, dynamic simulations of such facilities can then be performed for variable fluids qualities. In this paper, analyses of thermodynamic models available in commercial process modelling software tools are conducted for two example applications. The performance of thermodynamic models in commercial process simulation software packages (such as HYSYS) in predicting the transient behaviour of high pressure natural gas in CNG loading and unloading systems is investigated. The inefficiency of models and challenges involved in the accurate simulation of CNG transportation processes are also discussed. In addition, the performance of the thermodynamic models is also discussed for predicting Joule-Thomson effect in a typical crude production system during start-up operations.*

Keywords: Phase behaviour, Natural Gas Transportation, Equations of State, Binary Interaction, Dynamic Process Simulation, Joule-Thomson