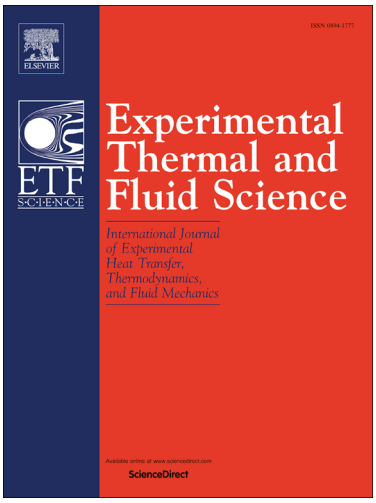

Relation of Heat and Mass Transfer in Wax diffusion in an Emulsion of Water and Waxy Crude Oil under Static Condition

Si Li, Qiyu Huang, Dan Zhao, Zhijuan Lv

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Relation of Heat and Mass Transfer in Wax diffusion in an Emulsion of Water and Waxy Crude Oil under Static Condition

Si Li [a,b], Qiyu Huang [a,*], Dan Zhao [a] and Zhijuan Lv [a]

[a] *Beijing Key Laboratory of Urban Oil and Gas Distribution Technology, China University of Petroleum-Beijing, Beijing 102249, China*

[b] *Department of Oil and Gas Storage and Transportation Engineering, Liaoning Shihua University, Fushun 113001, China*

Abstract: Wax diffusion characteristics are of great importance to the wax deposition prediction in crude oil pipelines. The wax diffusion process of water in oil emulsion (w/o emulsion) is more complicated on account of the influence from dispersed water phase. This study aims to reveal the relation of heat and mass transfer in wax diffusion with the effect of dispersed water phase. Via wax diffusion experiments of w/o emulsion on cold finger apparatus, the variations of the average wax diffusion rate with water fraction, temperature difference and diffusion period are obtained under static condition. A method to calculate the equivalent thermal conductivity of wax deposit is proposed according to emulsion property and deposit composition. Based on this, the radial temperature fields inside crude oil and emulsion after different diffusion periods are simulated. The results provide the evidence that the existence of water phase is able to influence wax diffusion by altering the radial temperature distribution. In addition, by comparing the variations of radial temperature field and wax diffusion rate, the close interaction effect between them is clarified. This study will offer useful information to the mechanisms study and the prediction of wax deposition in oil-water multiphase transportation pipelines.

Keywords: crude oil emulsion; wax deposition; molecular diffusion; temperature gradient; heat