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Microfluidics for Solvent-based Bitumen Recovery: Pore-Scale and Fluid Property Measurements

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Steam assisted gravity drainage (SAGD) is the main technologically and economically feasible method for *in situ* bitumen extraction. While SAGD is effective, the steam generation process is a major source of CO2 emissions, and many strategies are currently under test to improve both the environmental and economic performance. Solvent-based processes –either pure solvent injection or coinjection of solvent with steam –have proposed to improve SAGD performance. The addition of solvent, however, complicates an already complex multicomponent thermal-chemical process. Microfluidics is well suited to quantify the pore-scale of solvent-based recovery processes as well as rapidly determine the fluid properties with a tight control over experimental parameters. Here, we developed a suite of microfluidic platforms with relevant reservoir and fluid characteristics combined with optical-thermal imaging to (1) study pore-scale transport in solvent-based processes (e.g., recovery rate, emulsification, and precipitation) using both pure solvents and industrial diluents; and (2) measure fluid properties relevant to solvent-bitumen systems (e.g., solvent solubility and diffusivity). With strong potential to inform oil sand operators, microfluidics is faster (minutes instead of hours/days) and significantly cheaper than conventional methods; all stemming from small fluid sample required for experiments.

References

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