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Phase separation during mixing of partially miscible fluids under near-critical and supercritical conditions, and the phenomenon of "uphill diffusion"

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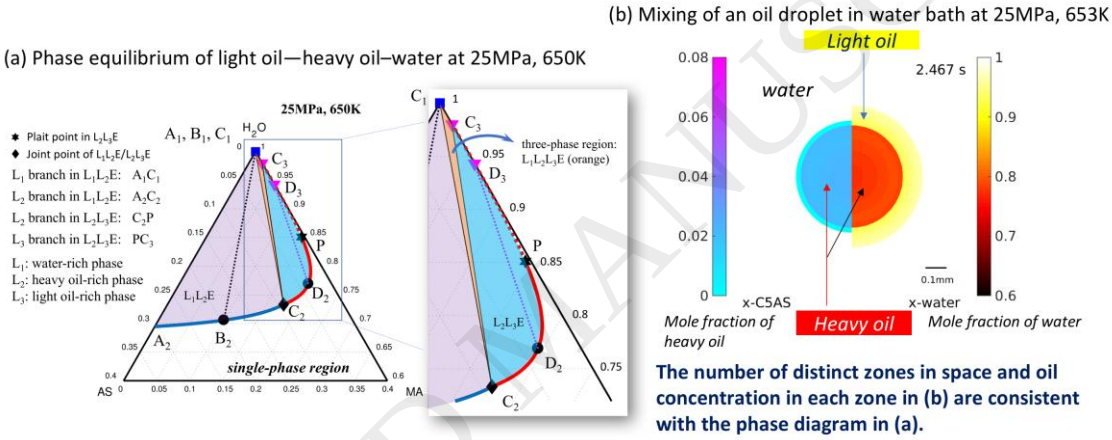
GraphicalAbstract



Highlights

- Partially miscible fluids under near-/supercritical conditions being studied
- Three regimes exist in phase diagram of light oil-heavy oil-water at 25MPa
- Mixing of a two-component oil droplet in near-/supercritical water being studied
- Mixing is driven by the heat and mass transfer from water bath to the oil droplet
- Number/concentrations of distinct zones in mixing consistent with phase diagram

Abstract

Partially miscible fluids often exhibit complex behavior. While previous studies have focused on the phase characteristics, the coupled phase equilibrium and transport processes under near-critical/supercritical conditions are not well studied. Here, the binary/ternary phase equilibria of light oil (maltenes)—heavy oil (asphaltenes)—water mixtures, are examined at 25 MPa and 640—660 K. Within this temperature range, three regimes exist in the ternary phase diagram. Next, the mixing of a two-component oil

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