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| Given Name | Surname | Company |
|---|---|---|
| Peixi | Zhu | University of Texas at Austin |
| Lucas | Mejia | University of Texas at Austin |
| Matthew Thomas | Balhoff | University of Texas at Austin |
| Kishore K. | Mohanty | University of Texas at Austin |
| | | |


# Abstract


**Objectives/Scope:**
Surfactant-polymer (SP) flooding can effectively improve oil recovery factor by reducing the interfacial tension to ultra-low level, generating microemulsion that mobilizes stranded oil blobs and creating an oil bank. Polymer can be injected to chase the SP slug and maintain the integrity of the SP slug and increase sweep. In this work, micromodels that have 2.5D pore feature and length scale of core samples (~2ft, 90,000+ pores) were created to study chemical EOR mechanisms.

**Methods, Procedures, Process:**
Micromodel with long and serpentine porous medium of 2 ft were fabricated. 2.5D realistic pore structure were also created (Xu et al., Lab Chip, 2017). The oil saturated micromodel was injected with water until residual oil saturation, then either SP continuously at 1.5 ft/day or SP slug followed by polymer chase. The SP formulation allows microemulsion phase behavior and ultralow IFT at optimal salinity. The entire displacement process was recorded with cameras at multiple scales. The polymer concentration was varied in both SP slug and chase polymer bank and its effect on oil bank formation was studied.

**Results, Observations, Conclusions:**
Fig. 1(a) shows a micromodel at the end of waterflooding. Fig. 1(b) shows a snapshot of micromodel flooded by 0.5 PV of SP. The microemulsion can be identified by using a hand-held microscope that shows flow pattern at the pore level. The regions of oil phase, microemulsion and surfactant are labeled in Fig. 1(b). An oil bank that has higher saturation near the microemulsion front can also be identified when comparing with the snapshot at the end of waterflooding (Fig. 1(a)). The microscope also shows that the oil bank contains displaced oil and water-in-oil-in-water emulsion. The oil saturation in the entire micromodel was plotted against the pore volume injected (black curve, Fig. 1(c)). A dramatic decrease in saturation was observed at the onset of SP injection, which is a result of efficient displacement due to oil bank formation. The remaining oil saturation is nearly zero after 2PV of SP injection. In a separate experiment, 0.5 PV of SP slug was injected followed by continuous polymer injection. The SP/polymer injection also shows similarly efficient displacement (blue curve, Fig(c)). It suggests that SP/Polymer injection is much more cost effective because of significantly less surfactant usage.

**Novel/Additive Information:**

Long serpentine 2.5D micromodels that have realistic pore geometry and length scales of conventional cores were created. The micromodel allows direct visualization and fundamental chemical EOR study at the pore scale. It serves as a low-cost approach to pre-screen EOR methods. In surfactant-polymer flooding, important recovery mechanisms such as microemulsion generation, double emulsion and oil bank formation can be visualized by the micromodel experiments.