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DISPLACEMENT OF TRAPPED OIL ON ROUGH SURFACES BY NANOPARTICLES

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Nanoparticles (NPs) possess great application potential in enhanced oil recovery (EOR). However, the EOR effects and mechanisms of specific NPs are not clear. In the study, the molecular dynamics (MD) simulation is thus adopted to explore the displacement of trapped oil on the rough surface by various NPs. Our results indicate that hydrophilic NPs and Janus NPs hold a greater EOR effect, while hydrophobic ones are not suitable for oil film. Specifically, hydrophilic NPs increase the viscosity and the sweeping scope of injected fluid. Janus NPs are prone to stay at the oil-water interface to reduce the interfacial tension. Most of them adsorb on the bulge, alter the surface wettability, and squeeze the trapped oil while others remobilize the trapped oil by sliding along the interface. Due to the entering of a large number of hydrophobic NPs inside the oil clusters, the influence of oil molecules being bound by NPs greatly reduces the effect of volume replacement, which leads to a poor displacement effect and even a risk of plugging the channel. Our findings are favourable to understanding the mechanism of nanofluids in EOR and provide guidance on the optimization of NPs.