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Displacement enhancement by nanogel-in-oil suspension with macroemulsion evolution in porous media

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Nanogel particles are emerging as an attractive additive for multiphase displacement control in natural processes and engineering systems. However, different from microgel or inorganic nanoparticles, the performance and mechanism of nanogel particle suspensions have not been well explored yet. In this study, we discovered a novel nanogel-in-oil colloidal state formed naturally with ideal sphericity and long-term stability, and characterized its impact on suspension and interfacial properties. In microfluidic experiments, visualization and quantification of the displacement process revealed the enhanced displacement mode from particle retention and flow field fluctuation, to aqueous ganglion breakup and in-situ formation of macroemulsions. Non-monotonic concentration effect was explained by the pressure difference and emulsion state evolution. Comparative batch experiments were further performed to elucidate the unique property of nanogel-in-oil suspension. Our results shed light on the relationship between colloidal state of nanogel particle suspensions and multiphase displacement consequences, deepening understanding of multiphase dispersed systems.

Participation

In-Person

References

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