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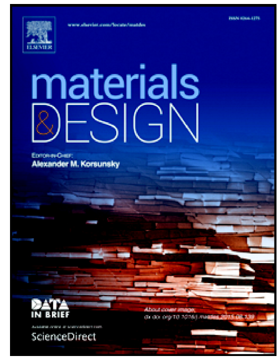

CO2-switchable nanohybrids for enhancing CO2 flooding in tight reservoirs: From stable colloids to a relevant viscoelastic fluid

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CO_2-switchable nanohybrids for enhancing CO_2 flooding in tight reservoirs: from stable colloids to a relevant viscoelastic fluid

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Abstract

Conventional CO_2 EOR techniques based on microscale chemicals have limited efficiency in tight reservoirs because the micro-nanopores of these reservoirs impede their injectivity and propagation in porous media. This work elucidated a novel well-defined silica nanohybrids named DMA-NPs with distinct CO_2 switchability for enhancing CO_2 flooding in tight reservoirs. DMA-NPs densely encapsulated with a CO_2-functional moiety of dimethylamine was synthesized by sequential surface modification and amidation reaction. The proof-to-concept for the CO_2-switchable nanohybrids was studied by TEM, TGA, SEM, ^{1}H NMR, FT-IR, DLS, rheological measurements and core flooding tests. The results indicated that DMA-NPs underwent reversibly physical transition, from stable colloidal particles with hydrodynamic diameter of 62 nm to a relevant viscoelastic fluid, by repeatedly bubbling CO_2 or introducing air to remove CO_2. Moreover, DMA-NPs dispersion whose viscosity was close to water, could preferentially flow through dominant porous media. When the dispersion met with the displacement front of CO_2, these stable colloidal particles self-assembled into a relevant viscoelastic fluid which reduced CO_2 mobility and diverted CO_2 into a lower permeable zone, and thus more than 30% of original oil in place bypassed by initial CO_2 displacement was recovered.

Keywords: silica nanohybrids; CO_2 switchable properties; tight reservoirs; relevant viscoelastic fluid; enhanced oil recovery.