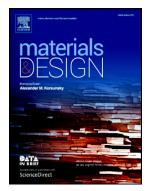
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CO₂-switchable nanohybrids for enhancing CO₂ flooding in tight reservoirs: from stable colloids to a relevant viscoelastic fluid

Rui Liu^{a, b, *}, Wanfen Pu^{a, *}, James J. Sheng^{a, b}, Daijun Du^a

^a State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation (Southwest Petroleum University), Xindu Avenue No. 8, Chengdu 610500, People's Republish of China

^b BoL L. Herd Department of Petroleum Engineering, Texas Tech University, P. O. BOX 43111, Lubbock, TX, 79409, United States

* Corresponding authors: breakthroughliu@163.com (R. Liu), pwf58@163.com (W. Pu)

Abstract

Conventional CO2 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 CO₂ switchability for enhancing CO₂ flooding in tight reservoirs. DMA-NPs densely encapsulated with a CO₂-functional moiety of dimethylamine was synthesized by sequential surface modification and amidation reaction. The proof-to-concept for the CO₂-switchable nanohybrids was studied by TEM, TGA, SEM, ¹H 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 CO₂ or introducing air to remove CO₂. 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 CO₂, these stable colloidal particles self-assembled into a relevant viscoelastic fluid which reduced CO₂ mobility and diverted CO₂ into a lower permeable zone, and thus more than 30% of original oil in place by passed by initial CO₂ displacement was recovered. Keywords: silica nanohybrids; CO₂ switchable properties; tight reservoirs; relevant viscoelastic fluid; enhanced oil recovery.

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