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## CO<sub>2</sub>-switchable nanohybrids for enhancing CO<sub>2</sub> flooding in tight reservoirs: from stable colloids to a relevant viscoelastic fluid

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### Abstract

Conventional CO<sub>2</sub> 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<sub>2</sub> switchability for enhancing CO<sub>2</sub> flooding in tight reservoirs. DMA-NPs densely encapsulated with a CO<sub>2</sub>-functional moiety of dimethylamine was synthesized by sequential surface modification and amidation reaction. The proof-to-concept for the CO<sub>2</sub>-switchable nanohybrids was studied by TEM, TGA, SEM, <sup>1</sup>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<sub>2</sub> or introducing air to remove CO<sub>2</sub>. 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<sub>2</sub>, these stable colloidal particles self-assembled into a relevant viscoelastic fluid which reduced CO<sub>2</sub> mobility and diverted CO<sub>2</sub> into a lower permeable zone, and thus more than 30% of original oil in place bypassed by initial CO<sub>2</sub> displacement was recovered. *Keywords:* silica nanohybrids; CO<sub>2</sub> switchable properties; tight reservoirs; relevant viscoelastic fluid; enhanced oil recovery.

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