

Current Challenges On Large Supramolecular Assemblies



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Next-Generation Supramolecular Assemblies as Displacement Fluids in EOR

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Abstract

Current analyses indicate that 50% of oil produced in USA and the world will be through EOR technologies in the next 20–25 years, and heuristics suggest that polymer flooding should be applied in reservoirs with oil viscosities between 10 and 150 mPa.s. The key factor limiting the recommended range is that for oil viscosities greater than 150 mPa.s, where injected water viscosity values required for a favorable mobility ratio give rise to prohibitively low values of polymer injectivity and pumping efficiencies. Herein, we propose that a novel type of supramolecular system based on the complexation of long chain amino amides and maleic acid with reversibly adjustable viscosities can enable us to overcome the injectivity limitation.

The concept is that viscosity of the injected supramolecular system will be maintained initially at low values for easy injection and pumping, and then increased by means of an external pH stimulus just before or upon contacting oil. Our promising lab-scale preliminary studies have indicated that such supramolecular systems possess not only reversible pH-responsive properties, but are also very tolerant to high salinities and temperatures.

While polymers degrade and break up upon experiencing sudden extreme shear stresses and temperatures, supramolecular solutions merely disassemble and re-assemble. Therefore, supramolecular solutions can be considered as healable polymer solutions in a way. Supramolecular solutions can adapt to the confining environment. For instance, when a high molecular weight polymer macromolecule is forced to flow into narrow channels and pores, molecular scission processes may take place.

Supramolecular solutions can have a significant impact in the cases where thermal methods cannot be used for some viscous oils due to thin zones, permafrost conditions and environmental constraints. This project is primarily aimed at developing novel supramolecular assemblies with adjustable viscosity and interfacial properties that have robust tolerance against high temperatures and salinities. Such supramolecular assemblies will be used to significantly improve the feasibility and cost-effectiveness of displacement fluids used in EOR. Overall, there is a significant potential for application of supramolecular solutions in the US and throughout the world.

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