KUIC Technology Profile

Improved Oil Recovery– Nano Scale Chemical Delivery System for In-Depth Profile Modification

Summary:
Based on precision drug delivery technologies, ConocoPhilips and KU have jointly developed a patented technology using polyelectrolyte complex (PEC) nanoparticles to entrap/protect and delay the release of oil and gas field chemicals.

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Applications:
One application of the PEC nanoparticles is the delayed release of crosslinking agent for polymer gels used in water shutoff and conformance control.

Unproductive cycling of injected water of EOR chemicals through high-permeability channels often results in poor volumetric sweep and hence low hydrocarbon recovery efficiency. Polymer gels can be used to block the high-permeability channels, forcing the subsequently injected fluids into the previously unswept oil productive zones. To maximize recovery efficiency, the gel needs to be placed deep into the formation.

The main issue with the current polymer gel systems is the short gelation time. A polymer gel usually consists of a polymer and a crosslinking agent. Once the gel is formed, it can no longer propagate in porous rock. Therefore, the gelation must be delayed to allow in-depth penetration. However, the gelation times of the current systems - ranging from hours to days - are generally too short. Using PEC nanoparticles to control/delay the release of crosslinking agent, the gelation times can be extended from days to weeks or even months.

Overview:
To maximize hydrocarbon recovery, the oil and gas industry injects all kinds of expensive chemicals into underground reservoirs. Due to the often hostile underground environments, there is a strong incentive to develop improved techniques to protect and control/delay the release of oil and gas field chemicals so that they can be successfully transported to the target locations underground. Based on precision drug delivery technologies, COP and KU have jointly developed a patented technology using polyelectrolyte complex (PEC) nanoparticles to entrap/protect and delay the release of oil and gas field chemicals. The concept is very similar to targeted cancer treatment where the toxic cancer-treating drugs are protected and their release delayed until they are delivered to the target cancerous cells.

The PEC nanoparticles consist of two low-molecular-weight polymers each carrying a different charge. They self-assemble into nanoparticles once mixed together. The formulations vary based the chemical entrapped and the release time. They can be combined in the field through a simple inline mixing method.

Patents: US 7,644,764; US 8,183,184; US 8,372,786

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Tags: Petroleum