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A novel relative permeability modifier polymer

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A new relative permeability modifier (RPM) has been developed for sandstone formations that are capable of reducing the permeability to water without impairing the permeability to oil. The new polymer has the capacity to anchor to the formation, allowing it to endure production fluid flow. Laboratory data were obtained in core flow test using high permeability sandstone cores (1.5 to 2 Darcies air permeability Berea Sandstone) at 200o F. The core flow sequence followed was to measure the relative permeabilities of oil at irreducible water (2% KCl) saturation and to water (2% KCl) at irreducible oil saturation before the injection of the RPM polymer. Then, the RPM polymer solution was injected into the core in the opposite direction (injection direction). The system was shut-in for one hour to facilitate polymer anchoring and re-organization. The relative water saturation was then determined by injecting 2% KCl in the production direction, followed by the oil relative permeability. One last water permeability was measured with 2% KCl after the oil permeability to determine the ability of the polymer to anchor to the core. Results indicate that the polymer can remarkably reduce the permeability to water without significantly impairing the permeability to oil. The regain relative water permeability was less than 20% after the injection of RPM polymer; the subsequent regain relative oil permeability was more than 75% and the regain relative water permeability was less than 30% after the oil injection. Results also indicated the RPM polymer had similar performance regardless of the injection direction used. Moreover pre-flushing the core with mutual solvent and surfactants before the polymer treatment did not have a significant effect on the performance of polymer. The capacity to selectively modify the water permeability makes it feasible to use this RPM polymer as near wellbore or far field treatment to reduce the excessive water production. Moreover, the polymer can be applied without the use of a mutual solvent and surfactants.

Biography

Chao Yang has obtained his PhD degree in chemistry from Virginia Tech. He has been working in stimulation and production chemicals since 2013.

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