

Performance Evaluation and Plugging Characteristics of Controllable Self-Aggregating Colloidal Particle Profile Control Agent

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Abstract : It is difficult to realize deep profile control because of the small pore-throats and easy water channeling in low-permeability heterogeneous reservoir, and the traditional polymer microspheres have the contradiction between injection and plugging. In order to solve this contradiction, the controllable self-aggregating colloidal particles (CSA) containing amide groups on the surface of microspheres was prepared based on emulsion polymerization of styrene and acrylamide. The dispersed solution of CSA colloidal particles, whose particle size is much smaller than the diameter of pore-throats, was injected into the reservoir. When the microspheres migrated to the deep part of reservoir, these CSA colloidal particles could automatically self-aggregate into large particle clusters under the action of the shielding agent and the control agent, so as to realize the plugging of the water channels. In this paper, the morphology, temperature resistance and self-aggregation properties of CSA microspheres were studied by transmission electron microscopy (TEM) and bottle test. The results showed that CSA microspheres exhibited heterogeneous core-shell structure, good dispersion, and outstanding thermal stability. The microspheres remain regular and uniform spheres at 100°C after aging for 35 days. With the increase of the concentration of the cations, the self-aggregation time of CSA was gradually shortened, and the influence of bivalent cations was greater than that of monovalent cations. Core flooding experiments showed that CSA polymer microspheres have good injection properties, CSA particle clusters can effectively plug the water channels and migrate to the deep part of the reservoir for profile control.

Keywords : heterogeneous reservoir, deep profile control, emulsion polymerization, colloidal particles, plugging characteristic

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