

ASPHALTENE DEPOSITION PREFERENCE AND ITS INFLUENCE ON RESERVOIR PERMEABILITY REDUCTION: A STUDY BASED ON MICRO X-RAY TOMOGRAPHY

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ABSTRACT

Pressure, temperature and petroleum composition change during natural depletion or CO₂ injection may lead to asphaltene flocculation, deposition and adsorption on pore surface. The deposited asphaltene blocks the reservoir pore throat by entrainment and bridge plugging, which reduces the reservoir permeability. The relationship between asphaltene saturation and reservoir permeability have been previously speculated through production data analysis, physical experiment and numerical simulation. Very few studies have tested real samples from reservoirs undergoing asphaltene deposition. Even fewer have analyzed permeability reduction mechanism in micro pore scale. In our work, real sandstone samples were collected from the reservoirs, who have encountered asphaltene deposition, in Guantao formation, Bohai Bay basin. The samples were sealed and scanned by an X-ray microscope to acquire 3D pore space images. By comparing the samples with and without asphaltene contained, the deposited asphaltene is identified. Next, the samples are going to be asphaltene-washed and scanned again to verify the identification. A skeleton algorithm is to be applied to the 3D pore space images to generate pore network models and then calculate the asphaltene saturation in each pore. By comparing the real asphaltene distribution with the one of the homogeneous precipitation model, a more reasonable 3D asphaltene deposition model will be found. A Navier-Stokes simulation will be conducted in the 3D pore spaces before and after the asphaltene deposition to calculate the permeability reduction. From these results, a 3D model of asphaltene deposition preference and a better knowledge of permeability reduction regularity will be provided for EOR strategy development.

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