Contribution ID: **280** Type: **Poster (+) Presentation**

Experimental Evaluation of Polymeric Fluid Displacement in Carbonates using an X-ray Imaging Technique

Thursday, 3 June 2021 20:00 (1 hour)

The filter cake formation during overbalanced drilling, and later on, its displacement and rearrangement during production are key parameters that impact formation damage, fluid loss control, and ultimately, effective production of hydrocarbon fluids. To address these issues, we investigate the impacts of non-Newtonian fluid rheology and pore space topology on the inner filter cake formation and its subsequent rearrangements as the result of a series of oil injections. We have performed two sets of experiments with two different concentrations of xanthan gum (XG) solutions (i.e., 0.2 and 0.4% w/w), and three different oil flow rates. The different oil flow rates mimic different areas of the reservoir during oil production. The cores were obtained from a water-wet carbonate outcrop and placed in aluminum core holders. One of the cores has a vertical fracture, the impact of which in terms of the XG-to-oil displacement is evaluated. We use the non-destructive 3D technique of X-ray micro-computed tomography (micro-CT) that enables tracking of pore fluid occupancy and visualizing the internal structures of the porous media. We have carried out extensive image analysis and proposed a novel methodology to account for the microporosity contribution to the total core porosity. Micropores are small pores that can not be identified at the acquired micro-CT resolution and are often seen as grey colors in the images. Reference and target-state images are taken after polymer injection and after each oil flooding, respectively. We first filtered the reconstructed images, then registered target and reference state images, and lastly segmented the XG and oil phases from the resolved pore space. The final segmented images are analyzed to obtain saturation profiles, pores'attributes that hold a specific phase, and cluster size distributions. As the different cycles of oil injection were performed, the number of pores holding XG in the center decreased, and the polymer was left at small pores. The fracture is filled with oil right after the first drainage. We also identify polymer retention near the inlet face of both cores. In core 1 with a higher permeability value, the well-connected pore space favored the formation of large oil clusters and coalescence among the remaining XG clusters. In core 2 with less permeability, the thin throats and small pores hindered polymer displacement; thus, a higher residual XG saturation is achieved at the end of oil injection processes. Our experimental findings highlight the interplay of the reservoir's petrophysical characteristics and mud rheology in the filter cake formation and displacement behavior, giving an approach to reduce permanent damage and assess efficient oil production.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

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Primary author: Ms BRANDÃO COSTA SANTOS, Nara (UFU)

Co-authors: Dr ZOLFAGHARI, Arsalan (Thermo Fisher Scientific, Materials and Structural Analysis); Dr RIBEIRO DAMASCENO, João Jorge (UFU); Dr OLIVEIRA AROUCA, Fábio (UFU); Dr NEGAHBAN, Shahin (KU); Dr KALANTARI DAHAGHI, Amirmasoud (KU)

Presenter: Ms BRANDÃO COSTA SANTOS, Nara (UFU)

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