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INFLUENCE OF SIO2 NANOFLUID ON ENHANCED OIL RECOVERY INSIDE A TRANSPARENT MICROPOROUS MEDIA

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With the rapid development of the world economy, the demand for energy, especially oil, is increasing. Therefore enhanced oil recovery (EOR) has become an essential part of crude oil exploitation. EOR consists of a recovery process by the injection of materials not existing in the reservoir. At present, four primary techniques of EOR are available in industry: Gas flooding, thermal injection, microbial recovery and chemical process. Addition of nanoparticles to chemical reagents is a new chemical flooding method, which can enhance and improve certain properties at low volume concentrations of the dispersing medium. It has the following advantages: (i) increase the stability of dispersing medium because surface forces easily counteract the force of gravity and (ii) change the optical, thermal, stress-strain, electrical, magnetic and rheological properties that strongly depend on size and shape of the nanoparticles. Therefore, it is evident that there is significant practical meaning to develop nanofluids for oil and gas production. The objective of this study is to investigate the properties of a nanofluid (SiO2) and its effect on Enhanced Oil Recovery (EOR) processes. The experimental setup consists of a digital microscope, trasparent microporous media, a syringe pump (Cole-Parmer Dual Rate) and a beaker. To mimic a transparent porous media a network of squares was designed and fabricated inside a microchannel having the dimension of 750 μm × 150 μm × 35 μm (length × width × depth). The syringe pump is used to inject crude oil, DI-water and nanofluid into the microporous media made of PDMS. The flow rate can vary from 4×10-4 μl/h to 1×10+7 μl/h. Once the microchannel is filled with crude oil, DI-water (or nanofluid) is injected until breakthrough happened. During injection processes, oil saturation was monitored by taking high-resolution video. The flooding process was observed using a microscope (Leica DMS300) from the top of the horizontal microchannel. The magnification of the microscope is between 15 to 120 times. Video with a resolution of 1920 × 1080 pixels was recorded. To quantify the characteristics of flooding efficiency, the obtained images were analyzed (using MATLAB) to measure the residual oil inside the microchannel. Surface tension and viscosities of SiO2 is measured by drop volume method and vibration string methods, respectively. Its stability and particle size were characterized using observational and dynamic light scattering method, respectively. The obtained experimental results reveal that with the addition of nanofluid in the brine, SiO2 nanofluid trends to increase surface tension. Performance of working fluid (DI-water or nanofluid) on flooding process are compared. It was observed that the recovery effects of SiO2 is better than DI-water.

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References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

In person

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