

PRF Grant# 59031

Understanding the Underlying Mechanisms of the Effect of Water Composition Modification on COBR Properties in Carbonate Limestone Rocks

PI: Reza Barati Ghabfarokhi

Graduate Research Assistant: Joel Tetteh

The ACS PRF funding has helped the PI develop capabilities in terms of understanding the mechanisms underlying the low and modified salinity waterflooding as a successful Enhanced Oil Recovery (EOR) method for carbonate reservoirs. As a result of this funding, the PI has collaborated with scientist with a multidisciplinary background from Geology, Chemistry, Geochemistry and Bioengineering to apply techniques developed in those areas and improved the classical petroleum engineering methods used to investigate EOR. Our team has utilized methods such as Raman Spectroscopy, Fourier-transform infrared spectroscopy (FTIR), scanning electron microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS) in addition to the measurement of dilatational viscoelasticity using interfacial tension measurements to investigate the effect of salinity modification on oil-water interaction as a standalone mechanism or coupled with dissolution of carbonate rocks. Guidelines and workflow were established by this group for future screening of carbonate reservoirs as potential candidates for low/ modified salinity waterflooding (Figure 1). This is very important as the majority of oil reservoirs around the world are prolific carbonate reservoirs. Considering the fact that the state of Kansas has also been producing oil from carbonate rocks that can be used as representative analogs to the reservoirs produced all around the world, part of our efforts has been focused on the Lansing Kansas City limestone crude oil-brine-rock (COBR) system that has been historically a source of oil in the mid-continent region.

A second-year PhD student (Mr. Joel Tetteh) who had taken the majority of his course work by the time this project started was hired and trained on different methods used in this project. In addition to completing his course work, writing a proposal for his dissertation and passing his comprehensive exam, Mr. Tetteh has prepared two manuscripts, one of which is under revision, as well as two presentations, an ACS presentation as well as a talk for the Kansas Government's Water Symposium, during the first year of this project. Mr. Tetteh is scheduled to continue working on this project as his dissertation project and graduate by the time this project is over.

This funding has helped with development of the necessary seed data for the PIs group to prepare a \$10 million proposal for the Department of Energy (DOE). Another proposal is being prepared based on the findings sponsored by this proposal to be submitted to the National science Foundation (NSF) for review.

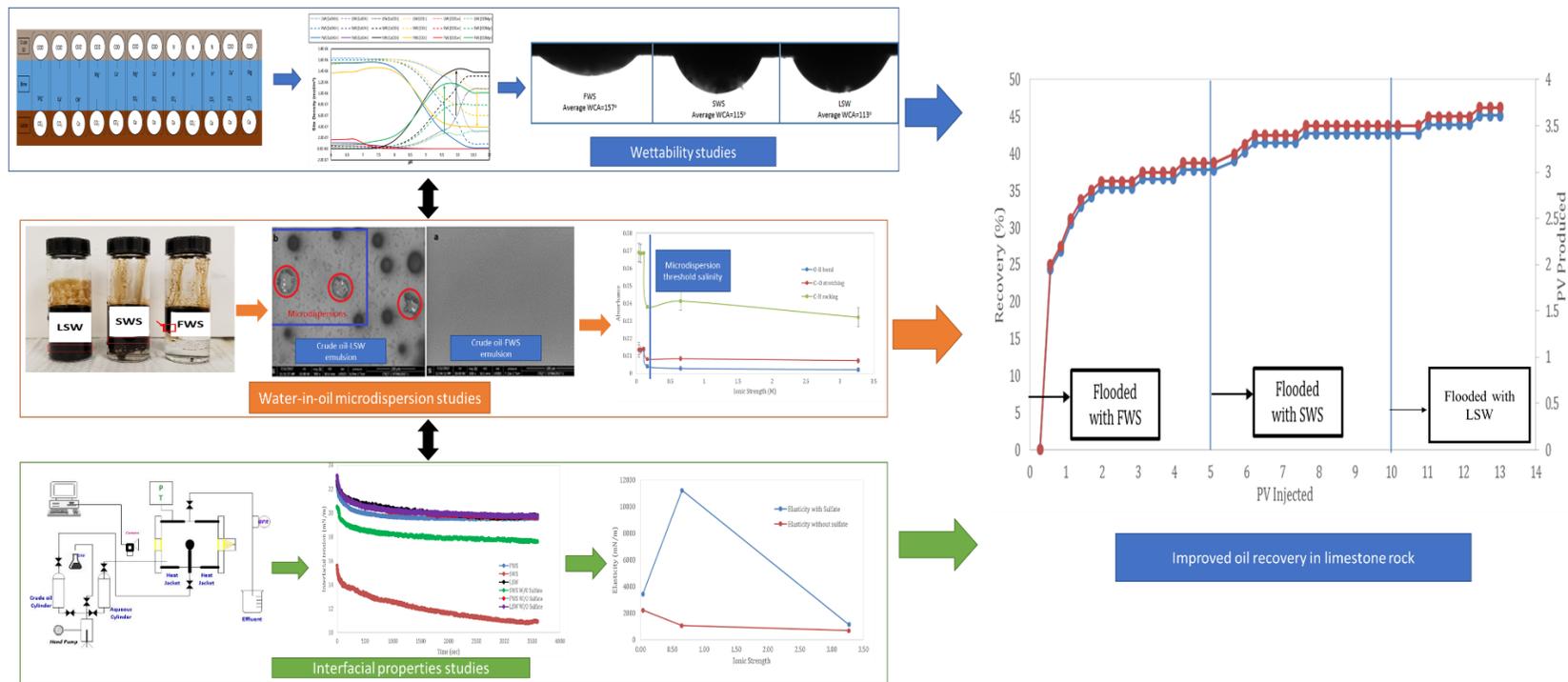


Figure 1 Workflow for future screening of carbonate reservoirs as potential candidates for low/ modified salinity waterflooding.