

## **Wettability Alteration in Reservoirs: How It Happens and How It Boosts Production**

**Geoffrey Thyne**

ESAL

### **Abstract**

Current economic conditions have challenged producers to find methods to lower costs and improve production. The current 50% reduction in oil prices means we need significant changes to stay competitive. Reservoir wettability can have a pronounced effect on hydrocarbon recovery and offers a method to substantially improve well performance and increase reserves for little investment. We know that each reservoir has a wettability state that leads to maximum recovery, but the initial wettability of a reservoir is usually not optimal. Traditionally, we have used surfactants and chemical agents to try and optimize reservoir wettability and recovery, but this process is expensive and does not always produce the desired results. This talk will outline recent advances in the science of reservoir wettability, as well as a practical methodology to realize the goal of increasing well recovery in unconventional and conventional reservoirs.

First, laboratory and field examples of successes and failures are considered. Using this basis, a theory is developed that directly links water chemistry and reservoir wettability. The theory also illuminates the key characteristics of the reservoir that control wettability. The approach can explain the successes and failures of low salinity waterflooding and provide the basis for designing the correct fluid chemistry while minimizing negative effects such as reservoir damage. This provides the ability to optimize reservoir wettability with simple systematic changes to the water chemistry of well fluids in both unconventional and conventional reservoirs.

The successful approach to reservoir wettability alteration requires several key steps: screening the formation to evaluate the applicability of the technique, simple laboratory tests to determine the optimal water chemistry and quantify the increased recovery, economic evaluations to estimate costs and benefits, and finally, comprehensive geochemical models to design the wettability-modifying fluids. The technique has several advantages compared to current methodologies for wettability alteration including substantially lower costs, no environmental impacts and ease of application.