Conducting Barite Scale Formations in Oil Production Reservoirs

Overview

Barite scale formation in oil production reservoirs is a serious problem. The scale forms when precipitation occurs from supersaturated solutions. This may decrease the efficiency of oil production and can even cause an emergency shutdown. To prevent such scale formation during oil production, inhibitors are commonly used, but it is important to study the formation rate (i.e., precipitation rate) of the scale under relevant oil production conditions. Thus, in this application note, the barite (barium sulfate) precipitation was studied under relevant oil production conditions.

Single Pump Experiment

As shown in Figure 1, liquid (e.g, $BaSO_4$) can be injected to flow through the Berea sandstone core by the Teledyne ISCO syringe pump and connected with a back pressure regulator. The flow rate can be controlled by operating the syringe pump in a constant flow mode. With this, the amount of barite precipitation inside the sandstone core can be measured. The precipitation is caused by the solution being super saturated.

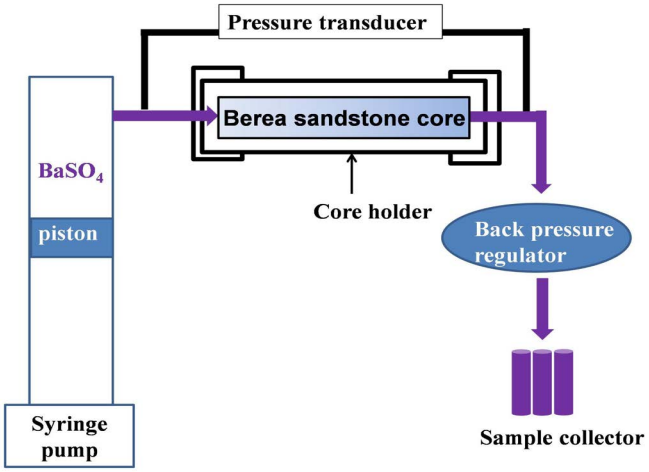

Figure 1: Single syringe pump set-up. Pressure transducer is used for readings only.

However, by doing this, the rate measured may not be accurate, as barite can start to precipitate inside the syringe pump.

Dual Pump Experiment

To prevent precipitation, two Teledyne ISCO syringe pumps can be used to inject two solutions through the sandstone core, allowing the two solutions to meet and react inside the core (Figure 2). The two solutions used for this experiment, $BaCl_2$ and $NaSO_4$ were chosen because once they mix the solution is super saturated with respect to barite, causing the barite to precipitate.

The two syringe pumps are ideal for this experiment since they can operate in constant flow or constant pressure mode. During reaction, barite ($BaSO_4$) will precipitate, which will change the permeability. The corresponding flow rate or pressure can be changed, which will be monitored by the two syringe pumps, thus, the permeability change of the sandstone can be calculated.

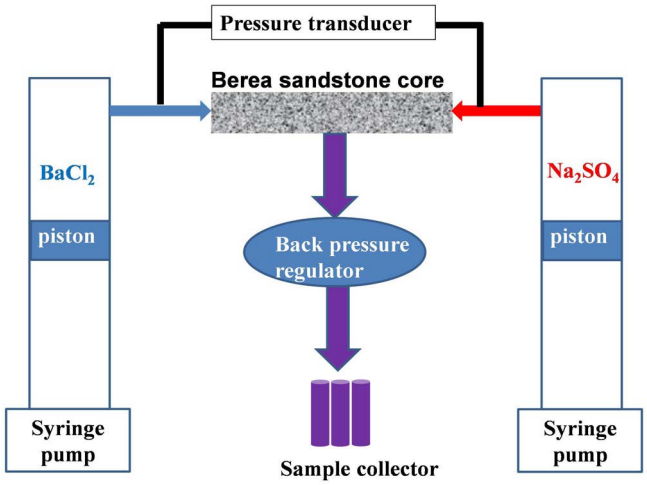

Figure 2: Dual syringe pump set-up. Pressure transducer is used for readings only.

Conclusion

Use of the Teledyne ISCO syringe pump together with its controller can accurately control the flow rate of the two solutions, in this way, we can study the barite formation under varied aqueous conditions (i.e., different flow rates, different ratios of Ba/SO_4).

February 13, 2014; revised November 8, 2023

Teledyne ISCO
P.O. Box 82531, Lincoln, Nebraska, 68501 USA
Toll-free: (800) 228-4373 • Phone: (402) 464-0231 • Fax: (402) 465-3091
www.teledyneisco.com