Conducting Iron Hydroxide Precipitation Reactions at High Temperature and High Pressure

Overview

Iron hydroxide precipitation is an important process in many subsurface environments, such as managed aquifer recharge, geologic carbon sequestration, as well as water injection enhanced oil production. Since iron hydroxide is the sink of many aqueous pollutants including: heavy metals, arsenic, and organic pollutants, it is important to study iron hydroxide precipitation rates, as well as the permeability decrease in an aquifer caused by its precipitation. It's also important to study the mobilization of aqueous pollutants.

In this application note the following experiment was conducted with acidic pH, which may corrode the inside wall of the syringe pump. To prevent the iron hydroxide precipitation inside the syringe pump, a novel setup was designed using the syringe pump and a Parr reactor.

Experiment

A syringe pump is used to mimic high pressure and high temperatures to inject inert gas (e.g, Ar or N_2) into the high temperature reactor (Figure 1). For this experiment N_2 is cycled to achieve and maintain a constant pressure and flow rate. If the N_2 is not enough, a valve can be closed between the syringe pump and reactor, then more gas can be refilled, the valve reopened and the reactor will be filled with more gas.

The out valve is connected with a dip tubing inside the solution in the reactor. Then, when the syringe increase pressure, the gas flows, and thus pushes the liquid into the sandstone core. In this way, the syringe pump can be used to set a constant flow rate, while the reactor is used to maintain a constant temperature of the liquid injected into the sandstone core. Also, this protects the syringe pump, as it won't come in direct contact with the corrosive liquid.

The permeability change of the sandstone can be measured using pressure transducer. Meanwhile, the pollutant concentrations in the effluent and influent can be compared, to understand the pollutants immobilized inside the sandstone core.

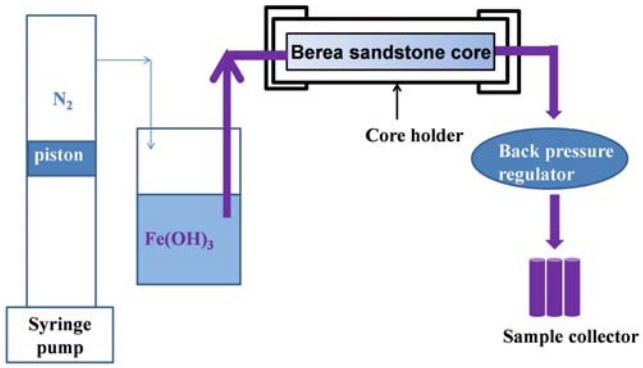

Figure 1: Syringe pump set-up with Parr reactor

Conclusion

Using gas injection to push solution into the core sample can prevent the direct contact of corrosive liquid with the syringe pump. Thus it prevents the corrosion of the syringe pump. Also, no cleaning of the pump is needed before different runs.

Teledyne Isco
P.O. Box 82531, Lincoln, Nebraska, 68501 USA
Toll-free: (800) 228-4373 • Phone: (402) 464-0231 • Fax: (402) 465-3091
E-mail: IscoInfo@teledyne.com