

Monitoring of charged wall growth inside pipes with impedance spectroscopy.

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The primary objective of this paper is to look on how impedance spectroscopy can be used for monitoring growth of scale inside pipes. When particles settle out (scale build-up) inside pipes the flow cross-section area is reduced, this will result in a pressure drop. It would be beneficial if this scale build-up could be monitored so preventive measures could be taken before the scaling starts to cause problems. The hypothesis is that an increase in scale build-up over time is accompanied with a change in impedance between the pipe wall and the reference electrode, witch can be measured with the help of impedance spectroscopy.

In order to control the scale build-up on pipe walls a electrical charge can be added to the pipe, this electrical field control of scale build-up has been widely used in industry for many years. The idea is to use the electrical charge to deter or increase the build-up of scale within the pipe.

A small scale experimental rig was constructed in order to test a monitor system based on impedance spectroscopy. The experimental rig consists of a vessel with two parallel stainless steel plates resembling a capacitor. Between the plates, a solution of water and calcium carbonate was added. This solution was circulated by a pump on intervals between measurements. For the impedance spectroscopy measurements a RCL meter was used, this device was connected to the stainless steel plates. The experiment was repeated with different voltage levels (DC bias on plates) to see how it Influenced the the scale build-up. When a experiment is running, particles will settle out (scale build-up) between the stainless steel plates and according to the hypothesis, an increased scale build-up is accompanied with a change in the impedance, this is measured by the RCL meter.

Results gathered from the experiments shows how an increase in scale build-up is accompanied with a change in impedance, witch can be measured with impedance spectroscopy (RCL meter). The experiment results also shows that adding a electrical charge alters the scale build-up.