

## **TWO-PHASE FLOW IN HETEROGENEOUS NODULAR POROUS MEDIA.**

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**Abstract** In this paper we present experimental results dealing with the flow of two immiscible fluids (drainage and imbibition) in nodular media with three different configurations.

1. Type I medium consists of three plugs of sandstone embedded in sand (both media being water-wet)
2. Type II medium consists in sand packed down in three holes drilled in sandstone (both media being water-wet).
3. Type III medium consists in an oil-wet sand (treated by silanization) packed down in three holes drilled in a water-wet sandstone.

The physical properties (porosity, permeabilities, capillary pressure, end-point saturations) of the regions composing the media were measured independently on isolated samples. During the drainage and imbibition experiments, the saturation was measured using a  $\gamma$ -ray attenuation apparatus.

After the drainage process, the initial water saturations are found different depending on whether the nodules are more permeable (sand) or less permeable (sandstone) than the continuous region. The values of saturation in the nodules and the continuous region are lower in the Type II medium than in Type I. In the case of oil-wet nodules, the initial water saturation in the nodules is found lower than in the other configurations.

The waterflooding of Type I medium presents a classical behaviour (breakthrough after 0.3 PV of water injected and low recovery). The behaviour of Type II experiment is different and shows a non-classical recovery curve. Oil recovery from the sandstone ceased after injecting about 0.3 PV of water, whereas the recovery from the sand continued even after injecting more than 30 PV. In Type III medium (nodules made of oil-wet sand), oil recovery from the sandstone has the same behaviour as in Type II experiment but we could not displace the oil trapped in the nodules.