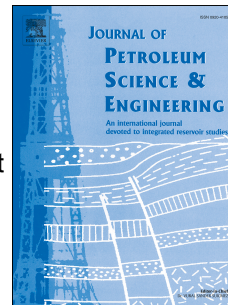


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The study of Influence of electromagnetic waves on the wettability alteration of oil-wet calcite: Imprints in surface properties

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Abstract

The wettability of reservoir rock is one of the fundamental parameters determining the flow of fluid in the porous media. This study has investigated the effect of microwaves on the wettability of calcite reservoir rock from Yaran, Iran, as the time interval of microwave radiation is one of the most important parameters affecting wettability. The reservoir rock samples were placed in a microwave oven filled with helium gas and subjected to microwave radiation at five-minute intervals from 5 to 35 minutes. Measurements of the contact angle between the oil and the rock indicated that the microwaves brought the angle from about 120° primary state to 93° at 35 minutes. At intervals of 5 to 15 minutes, no change in the wettability of the oil-wet rock was observed. Sulfur components had high absorption coefficients of microwaves, so initially reduced the amount of sulfur (S) on the surface of the oil-wet rock. Next, the nitrogen (N) and oxygen (O) elements were reduced, and eventually the carbon (C) levels began to decrease. This trend was observed in the zeta potential by changing the surface charge of the rock. Indeed, eliminating SNO polar compounds with a high potential for absorbing microwave caused the rock to become water-wet. Microwave radiation initially produced no change in the Fourier-transform infrared spectroscopy (FTIR) spectrum, as it continued, the peak intensity of the corresponding oil, such as the carboxylic acid functional group, declined, and the corresponding peaks of the rock became more intense, indicating a gradual change in the wettability. It can be interpreted that the aromatic compounds exist in oil and act as surface agent components. The results of this study can be used as a representation of the use of microwave radiation in hydrocarbon reservoirs to change the wettability and increase the production rate of reservoirs.

Keywords: Wettability; Heavy Oil; Microwave; Calcite; Polar.

1- Introduction

Wettability plays an important role in the production of oil in hydrocarbon reservoirs: it not only determines the initial distribution of fluids, but is also an important factor in the process of fluid flow in the porous medium of the reservoir. In hydrocarbon reservoirs, wettability is known to be

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