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Direct Measurement of the Contact Angle of Water Droplet on Quartz in a Reservoir Rock with Atomic Force Microscopy

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Abstract

The wettability of a reservoir rock is an important property affecting the states of fluids in pores that are constructed with minerals of various types. However, the mineral grains are usually micro-sized so that the traditional optical contact angle method is hard to be applied to study their wettabilities. Although some measurements have been carried out for the contact angles of liquids on mineral surfaces, those previous studies were mainly on flat artificial mineral surfaces. To understand the wettabilities of water on rough natural mineral surfaces, the contact angles of micro-sized water droplets on relatively rough quartz surfaces in a natural sand rock were measured with an atomic force microscopy (AFM). The results obtained show that the droplets were asymmetrical so that the contact angles, which were around 27.8 - 50.3 °, were different along the triple-phase contact lines, probably due to surface roughness, heterogeneity, atomic arrangement, etc. As compared with previous studies, surface pretreatment and droplet size were regarded as the two key factors that caused the substantial difference in contact angles of water

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