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Experimental study on oil well stimulation by dynamic shock wave induced by liquid pulsed current discharge

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This paper aimed at investigating the dynamic shock wave induced by liquid pulsed current discharge to increase the intrinsic permeability of the cement sheath and rock in the oil well. It is believed that the blockage at the oil well perforation can be broken and removed from the bore-hole wall, and the fracture to increase the permeability of the hole-bottom region can be formed under the repetitive dynamic shock waves. Then the oil production of the well is improved. In this paper, an equipment of the oil well stimulation based on the electrohydraulic shock waves is designed and constructed. In order to study on the performance of the oil well stimulation, some preliminary experiments are carried out on some hollow cylinder concrete specimens. The liquid gap voltage, main discharge current, and shock wave pressure as well as the time-resolved photographing of the plasma channel development and bubble formations were observed and presented during the experiments. The spectrum analysis of the shock wave is carried out and presented. In the small specimen test, the blockage on the holes, which simulates the well perforations, are damaged by the shock waves. During the large specimen test, the fractures are overserved as 4 shots discharge applied. As the shots increases, the cracking is extended, and then the specimen is damaged in pieces. The influence of the injected electrical energy and the applied shock wave shot number on the fracture of the specimen is investigated. The experimental results show that the shock wave can increase the permeability.

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