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The Crushing Characters of Quartz Sand Based on a New Experimental Image Processing Methods

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Hydraulic fracturing has gradually increased as an important means to enhance production in deep low permeability reservoirs. Whether proppant can maintain long-term high conductivity in fractures has become a hotspot. Quartz sand has been widely used due to its affordability and easy preparation. However, the strength of quartz sand is low. Under high closure stress, quartz sand is crushed, producing fine particles that reduce fracture width and permeability of sand piles, resulting in a rapid decrease in fracture conductivity. Therefore, it is crucial to study the fragmentation law of proppants under high closure stress. For the study of the fragmentation law of quartz sand, a lot of related experiments have been conducted both domestically and internationally, and quantitative methods such as screening method and laser particle size analysis have also been formed, but there are certain limitations. In this study, a new image processing-based quantitative method is developed to determine the compression proppant crushing rate. Compared with conventional screening methods to verify accuracy, this method can more quickly and efficiently quantify the proppant crushing rate. Subsequently, a crushing experiment of quartz sand was conducted using the proposed method, and the proppant crushing rate under different conditions was calculated. The influence of factors such as sand spreading concentration, particle size combination, and sand placement method on the proppant crushing rate was analyzed. The results of this analysis were consistent with previous studies, confirming the applicability of the proposed method. This research provides a theoretical foundation for hydraulic fracturing and optimization of sand placement in order to maintain long-term high conductivity in fractures.

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References

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