

EXPERIMENTAL HYDRAULIC FRACTURING TECHNIQUE FOR HARD ROCK IN-SITU RECOVERY ENHANCEMENT

By

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ABSTRACT

The mining industry faces challenges, including declining ore grades, increases in operating depth, increases in cost, and environmental problems related to tailings and backfilling. In-situ recovery (ISR) offers an alternative approach to extract target minerals from deposits without costly processing. However, when an orebody is impermeable, the application of a stimulation technique, e.g., hydraulic fracturing, is necessary to artificially create conductive flow channels for the leaching agent, i.e., lixiviant, to contact the targeted mineral.

Rock mechanical properties, hydraulic fracturing parameters, and field conditions are the governing factors that determine the suitability of a deposit for ISR. Limited experimental information is available on hard rock leaching combined with hydraulic fracturing. In this work, a summary of conducted experimental trials aimed at hard rock fracturing, including sample preparation, plus a sensitivity analysis of the governing fracturing factors are presented. Hydraulic fracturing fluid type, fluid injection rate, natural fracture distribution, and the variable stress strength and direction applied to hard rock samples were tested to evaluate their importance in ISR enhancement. The hydraulic fracture response with changes in fracturing pressure and its induced strain on the rock body will be included for evaluation. Outcomes from hydraulic fracturing experiments on hard rocks cover the hydraulic induced fracture geometry, strain data and X-ray computed tomography results. An extensive number of tests that combine test data monitoring and analysis will yield a better understanding in complex hard rock hydraulic fracturing processes, and the results provide practical guidance for further mining industrial practice.

Keywords: In-situ recovery; Hydraulic fracturing.