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Experimental investigation on H2S-induced oilwell cement degradation under high-temperature conditions

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Oilwell cement is a weak point in wellbores used for extracting geothermal resources. It can be corroded by acidic gas such as H2S under high-temperature. Previous studies have primarily focused on the immersion corrosion or one-phase corrosion of oilwell cement in H2S solutions, while corrosion along existing cracks requires attention. Given this, this study conducted experiments on the corrosion of H2S solution along channels within oilwell cement using a high-temperature-high-pressure flow reactor. The structural evolution of the cement under H2S corrosion was evaluated using CT scanning, while SEM and XRD texts were used to provide a micro-level mechanistic explanation. The results indicate that H2S corrosion leads to a decrease in the strength of oilwell cement and an increase in permeability. During H2S induced corrosion along the channel, the porosity of the cement increases, with the formation of more macro-pores. The wall of the channel undergo chemical dissolution and roughening, leading to an enlarged channel. The dissolution of primary minerals of the cement and the formation of secondary minerals such as pyrite are believed to destabilize the microstructure.

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References

Primary author: YIN, Yue (Institute of Rock and Soil Mechanics, Chinese Academy of Science)

Co-authors: Prof. ZHANG, Liwei (Institute of Rock and Soil Mechanics, Chinese Academy of Sciences); GAN, Manguang; Ms WANG, Yan

Presenter: YIN, Yue (Institute of Rock and Soil Mechanics, Chinese Academy of Science)

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