Study on casing stability under non-uniform ground stress for in-situ leaching well of one uranium

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ABSTRACT

With the depth of prospecting is increasing, casing damage caused by in-situ stress changes is a difficult geological engineering problem encountered in the process of in-situ leaching uranium.

As the borehole caving can show the direction of the ground stress, the scan images of the SY-02 borehole caving were gotted by ultrasonic borehole TV. The analysis results show that the direction of the maximum horizontal principal stress in the mine is NNE16°.

As the shape of pie core can be used to analyze the magnitude of the in-situ stress field, the ratio of the thickness to the diameter of 40m cores obtained by SY-02 borehole were calculated, and the maximum principal stress value was estimated to be 25.54 MPa at a depth of 730 meters.

Comparing the lateral pressure coefficient $k_{H\ max}$ (S_H/S_V) and $K_{H\ min}$ (S_h/S_V) calculated respectively in two different test sections nearby, the results of the borehole caving and the pie core, the relationship among the magnitude of the principal stress is $S_H>S_V>S_h$, the range of S_H/S_V is 1.6-1.1, and the range of S_h/S_V is 1.1-0.8, which indicate that the horizontal stress dominate control the stress field in this area.

Taking UPVC casing-cement sheath-stratum combined system as study target, the finite models were established. The numerical simulation results show that the non-uniform ground stress is the important cause of main casing damage. Meanwhile the mudstone creep will aggravate the non-uniformity of the ground stress. Under the condition of non-uniform stress, the plastic strain reaches 14% at a depth of 720m for 8 years and close to the plastic strain of 15%. The casing is likely to be damaged or excessively deformed.