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A visualization study of stress evolution in CBM horizontal well cavity completion

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The efficient exploitation of coalbed methane (CBM) plays an important role in reducing outburst hazards, securing energy supply and reducing carbon footprint. Horizontal well cavity completion performs well in Zhengzhuang Block, China, with stable daily gas production of 10,000 m3, which was four times more than that of the adjacent fractured well. However, the stimulation mechanism of horizontal well cavity completion is not clear and it is a challenge to directly reveal the evolution of stress and strain. This study proposes a method, finite discrete element method (FDEM), for characterizing fracture and describing stress and strain evolution. A visualization experimental device based on digital image correlation (DIC) was proposed to measure the strain field. Then the established FDEM model is calibrated based on observations from the experiment. And the effects of cavity diameter and in-situ stress on short-term response of stress evolution and fracture extension were investigated. The results show that numerical simulations are in good agreement with the experimental observations. The stress concentration occurs first around the cavity, and then induces fracture propagation, which further leads to stress release. The fracture extension and stress relief is limited in the vertical direction as the vertical stress decrease. The fracture length grows linearly with cavity diameter. The key findings of this study provide insights into the progress of stress reconstruction and fracture extension in CBM horizontal well cavity completion.

Participation

In-Person

References

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