

Study on the stratification effect of rock splitting and mode I fracture characteristics

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Abstract: To investigate the stratification effect on rock splitting and mode I fracture characteristics, standard Brazilian splitting disk specimens and straight crack disk specimens were subjected to splitting loading tests, and high-speed camera system and acoustic emission (AE) system were used to study on the mechanical properties of rocks, fracture parameters of rocks and AE characteristics. The results demonstrate the following: (1) The tensile strength and fracture toughness of the layered rock exhibit significant stratification effects, gradually decreasing with the increase in the number of layers and the layer angle; (2) The different angles of the stratification planes lead to the diversity of failure modes in the disk specimens; (3) The S-value and the cumulative AE count curve of specimens without prefabricated cracks show two types of patterns during loading: fluctuating increase mode and "gentle-steep" increase mode; (4) Layered rock specimens exhibit low the ratio of rise time to voltage amplitude (RA) values and high average frequency (AF) characteristics during fracture, and the shear failure mainly occurring during the stable propagation phase after the initiation of macroscopic cracks; (5) The fracture process zone (FPZ) length at the peak point of the specimens decreases exponentially with the increase in the number of layers, but this reduction does not go on indefinitely, and there exists a minimum value. Within the range of 0° to 60°, the FPZ length decreases linearly with increasing stratification angle.

Keywords: Tensile characteristics; Mode I fracture; Stratification effects; DIC; AE