

Shear fracture toughness of brittle rocks

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Abstract: The measurement of fracture toughness of brittle materials is important for predicting crack initiation and propagation, and tensile stress concentration at the crack tip should be considered when testing shear fracture toughness. New shear fracture tests were used to measure the mode-II fracture toughness of brittle material such as rock. A theoretical analysis indicates that high tensile stress occurs at the crack tip. We proposed a new method to measure shear fracture toughness, in which test samples are easier to prepare and are loaded symmetrically. A finite element method was used to analyze mode-II fracture toughness of brittle rocks. An existing method was modified based on the experimental and numerical results. The new method can avoid the moment caused by asymmetrical loading, and reduce the impact of the crack size effect significantly. Finally, fracture tests of pre-cracked sandstones were conducted using a material testing machine, and the formula for mode-II fracture toughness was obtained. The new test method is more appropriate for mode-II fracture toughness of brittle rock.

Key words: Mode-II fracture toughness; shear box test; sandstone; finite element method; correction factor