

Mechanical behaviors of mylonitic granite and granitic protomylonite in a deep ductile shear zone

Abstract: For projects near the tectonic belt, mylonite of varying metamorphic degrees may be present. The matrix proportion of rock reflects its internal microscopic characteristics, thus it is beneficial for engineering geology to study the effect of the matrix proportion on the mechanical properties and rupture behaviors of rock. Samples of mylonitic granite and granitic protomylonite with varying matrix proportions were obtained from a ductile shear zone for a series of uniaxial compression and acoustic emission (AE) tests. The results showed that with the increase in matrix proportion, the average strength and elastic modulus of the samples increased, and the rock sample with the largest matrix proportion exhibited the maximum peak stress of 244.42 MPa, which was 45.86% greater than the average peak stress of the rock samples with the smallest matrix proportions. For the rock samples with larger matrix proportion, their mechanical parameters exhibited greater dispersion and the large-scale appearance of AE events occurred earlier, showing a relatively gradual failure process. These samples had larger accumulated AE parameter values and greater degree of failure. In contrast, for samples with smaller matrix proportions, the large-scale appearance of AE events occurred close to the peak stress, indicating that the occurrence of damage and fractures was centralized and instantaneous. These samples had lower accumulated AE parameter values and fewer cracks after failure. Additionally, for the rock samples with more matrix proportion, the average variance of the b -value was 1.1, which was lower than that of rock samples with the smallest matrix proportion (the average variance of the b -value was 3.7). Furthermore, it can be predicted that under certain stress, the failure depth around a tunnel is generally smaller when the strength of rock samples with larger matrix proportion is greater.

Keywords: Mylonite, Matrix proportion, Mechanical properties, Acoustic emission (AE), Rupture behaviors