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AE characteristics in a triaxial extension test

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When a high deviatoric stress is applied to a granular rock, there occurs microfractures which accompanied by ultrasonic waves called acoustic emission (AE) are observed. AE is an elastic wave radiated in a deformation process, which is similar to a seismic wave. Some AEs correspond to open crack mode microfractures, and others correspond to shear mode microfractures. AE has been studied to monitor deformation process in a rock sample under a compressive stress state (e.g., Scholz, 1968; Lockner et al., 1992). Although it is expected that AE occurs prior to the main fracture in an unloading process under triaxial extensive stress state, the activity and characteristics of the AE have not been studied.

We carried out continuous AE measurement in a triaxial extension test under a confining pressure of 80 MPa, using a cylindrical Kimachi sandstone sample, 100 mm in height and 50 mm in diameter. The fractured sample showed an extensive fracture plane and a shear fracture plane. Waveforms of the same AE event recorded by different sensors are similar to each other, except for polarities of initial motion. We found AE waveforms with polarity of all dilatational and those with polarity of both dilatational and compressional, which indicates that there occurred both open crack mode microfractures and shear mode microfractures.

Keywords: Triaxial extension test, Kimachi sandstone, Acoustic emission, Focal mechanism