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Precise estimation of AE behavior prior to rock failure with continuous broadband recording

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A laboratory rock fracture experiment enables us to observe elastic waves radiated from micro fractures (Acoustic Emission; AE) at the proximity to the rupture plane. Previous experiments indicated that AEs are activated and concentrate on and around a future rupture plane prior to the rock failure (e.g., Yanagidani et al., 1985; Lockner et al., 1991). However, waves arrive within a mask time of the last trigger were missed in a trigger mode recording. Furthermore, they used narrowband recordings, so that information about source process could not be obtained. To apply the knowledge obtained from AE analysis, it is necessary that AE source parameters are estimated in a similar manner as natural earthquake parameters. Broadband records enable us to precisely estimate source parameters, such as rupture duration, seismic moment, and seismic energy. In this study, we conducted continuous and broadband recording through a uni-axial rock fracture experiment under a dry condition at an ambient temperature.

First, as a preliminary experiment, we prepared a cylindrical Oshima granite sample, 110 mm in height and 45 mm in diameter. A P wave type broadband transducer and a PZT (narrowband transducer) were attached on the both side surfaces of the sample. Recording was continued with 33MS/s even after the sample fractured.

Spectrum of waveforms showed clear variability of corner frequency, corresponding to their amplitude level. We will conduct further experiments with several broadband sensors, and discuss source characteristics of AEs, from the determination of source parameters of them.

Keywords: AE (Acoustic Emission), laboratory experiment, broadband, continuous recording, source process