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Laboratory experiments on dynamic rupture propagation using rocks

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Around pre-existing geological faults in the crust, we have often observed off-fault damage zone where there are many fractures with various scales, from $\sim\mu$m to $\sim$m and their density typically increases with proximity to the fault. One of the fracture formation processes is considered to be dynamic shear rupture propagation on the faults, which leads to the occurrence of earthquakes. Although much work on such off-fault damage associated with dynamic rupture in homogeneous material (ex. polymers) have been done in the past decades (Rosakis et al., 2007), the rupture-induced damaging behavior of rocks, that constitute the faults in nature and of which frictional properties controlling the dynamic rupture might be different from the polymers, is still experimentally unexamined.

Recently, I have worked on laboratory experiments on dynamic rupture propagation along contacting surfaces of two metagabbro blocks from Tamil Nadu, India, simulating a fault of 30 cm in length. For the experiments, the similar uniaxial loading configuration to Rosakis et al. (2007) is used. Axial load σ is applied to the fault plane with an angle θ to the loading direction. Changing the angle makes the ratio of shear to normal stress on the fault a critical level close to the maximum static frictional strength beyond which the fault begins to slip spontaneously. For the critically stressed fault, the triggering of rupture is archived by striking the one edge of the fault with a hammer and the subsequent increase in shear load for a short duration. The load cell attached to the tip of the hammer head can provide us the magnitude and time duration of the impact stress. In this presentation, I introduce the experimental set-up and some preliminary results for the dynamic rupture propagation on rocks. This work is supported by the JSPS KAKENHI (26870912).

Keywords: Dynamic rupture propagation, Rock, Fault, Experiment