

A new hydrothermal, low to high speed rotary-shearing apparatus: Reproduction of slow/megathrust earthquakes in laboratory

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Earthquakes involve a wide range of slip rates, from slow/aseismic to fast/seismic slip along faults. Thus, frictional properties of faults over wide slip rates (nm/s to m/s), in particular under hydrothermal conditions similar to those expected in seismogenic zones are essential for a unified understanding of all earthquake events. A new hydrothermal, low to high speed rotary-shearing apparatus has been installed at Kochi/JAMSTEC, in order to study the fault constitutive properties at slow to fast slip rates and the physicochemical mechanisms underlying mechanical responses. The apparatus is currently capable of applying slip rates from 100 nm/s to 2 m/s, normal stress up to 55 MPa, fluid pressure up to 120 MPa and temperature up to 450°C with infinite displacement. We have been improving the apparatus to work as we intended. In pilot tests, we used metamorphic rocks (pelitic and green schists) as starting materials that are potentially distributed at and below seismogenic zones along hot and young subduction zones. We will present our preliminary results with the basic design of the apparatus.

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