New test machine of low-high velocity friction experiments with hydraulic pressure

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A number of high-velocity frictional experiments have revealed the chemical process and mechanical mechanism of slip weakening during frictional melting. All these experiments have been conducted under dry conditions because the test machine lacks a hydraulic pressure system. A new and improved rotary-shear high-velocity testing machine has been produced equipped with a hydraulic pressure apparatus, which was installed in Shizuoka University, Japan, early in 2007. The new test machine contains two rotary-shear high-velocity testing devices: one with the same capacity as the original uniaxial high-velocity testing machine, and another that contains a hydraulic friction apparatus with a controlling device for high pore-water pressure attached to the uniaxial rotary-shear high-velocity friction device; this device has a wide range of slip rates, from ˜10 cm/yr to 10 m/s.

The new machine enables high-velocity friction experiments on faults with supercritical pore-water pressure and low rates of shear deformation; these experiments can be used to simulate both seismic and aseismic crystal plastic deformation processes of mynolite-related pseudotachylyte veins within fault zones where high pore-fluid

pressure is present. The two devices are set together with a single rotary axis that is powered by a single servo-motor. Preliminary experiments under high hydraulic pressure conditions are currently being carried out within the Laboratory of Earthquake Geology at Shizuoka University, Japan.

For testing this new machine, high-velocity friction experiments has been performed on gabbro and serpentine samples under large earthquake slip conditions. The experimental results show that frictional melting can be easily generated even under a high pore-water pressure. Our experiments on serpentinite samples also demonstrate that serpentine dehydration induced pronouncedly strength weakening of simulated fault during high velocity slipping.