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# Rupture nucleation and propagation along heterogeneously loaded, circular experimental faults

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We explored the evolution of dynamic rupture along circular experimental faults of two compositions: Sierra-White granite blocks and acrylic blocks. The ring-shaped fault surface has inner and outer diameters of 7.62and 10.16 cm, respectively, and an array of ten rosette strain-gages is attached to the outer rim of one block at distance of about 3 mm from the fault surface. The 30 components of the strain-gages are monitored at 10̂6 samples per second, and the data enables determination of the 2D strain tensor in a plane normal to the fault. One three-dimensional, miniature accelerometer is attached to the fault block. The initial asperities of the fault surface generated non-uniform stress distribution that was recorded by the strain-gages and pressure film, and indicated major local deviations from the mean stress. The mean normal stress was up to 3.5 MPa, the remotely applied velocity was up to .002 m/s, and the slip velocities during the rupture were not measured. The rupture characteristics, namely propagation velocity and rupture front strain-field, were determined from the strain-gages output.

The analysis of tens stick-slip events revealed the following preliminary results: (1) The rupture consistently nucleated at sites of high ratio of [shear-stress/normal-stress] that was measured before loading by remote velocity. (2) Rupture nucleation was recognized by temporal (< 0.1 s) reduction of the local (<20 mm) shear stress that was commonly associated with micro acoustic emissions. (3) Nucleation could occur quasi-simultaneously (with time resolution) at two, highly stressed sites. (4) From the nucleation site, the ruptures propagated in two directions along the ring-shaped fault, and the collisions between the two fronts led to rupture 'shut-off'. (5) The strain-field of rupture fronts was well-recognized for ruptures propagating faster than $\sim$ 20 m/s, and the fastest fronts propagated at $\sim$500 m/s. (6) Post-shear examination of the fault surfaces revealed evidence of brittle wear recognized by gouge formation, ploughing, and powder smearing. Work in progress includes attempts to achieve faster dynamic ruptures and detailed characterization of the rupture front.