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Direct Measurement of Pressure and Temperature Variations During High-Speed Friction Experiments

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Abstract : Thermal Pressurization (TP) has been proposed as a key mechanism involved in the weakening of faults during dynamic ruptures. Theoretical and numerical studies clearly show how frictional heating can lead to an increase in pore fluid pressure due to the rapid slip along faults occurring during earthquakes. In addition, recent laboratory studies have evidenced local pore pressure or local temperature variation during rotary shear tests, which are consistent with TP theoretical and numerical models. The aim of this study is to complement previous ones by measuring both local pore pressure and local temperature variations in the vicinity of a water-saturated calcite gouge layer subjected to a controlled slip velocity in direct double shear configuration. Laboratory investigation of TP process is crucial in order to understand the conditions at which it is likely to become a dominant mechanism controlling dynamic friction. It is also important in order to understand the timing and magnitude of temperature and pore pressure variations, to help understanding when it is negligible, and how it competes with other rather strengthening-mechanisms such as dilatancy, which can occur during rock failure. Here we present unique direct measurements of temperature and pressure variations during high-speed friction experiments under various load point velocities and show the timing of these variations relatively to the slip event.

Keywords : thermal pressurization, double-shear test, high-speed friction, dilatancy
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