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SSS29-P10 Room:Convention Hall Time:May 22 17:00-18:30

The influence of lubricating agents for the strength reduction of faults

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The weakness of mature faults, which is presumed by lack of heat flow anomaly and stress orientations around faults, is still open to argument. One of the explanations for these weak faults is that the presence of weak minerals (fault lubricants) such as phyllosilicates along the fault zones. Frictional experiments on bimineralic mixtures with phyllosilicates are conducted to examine its operation for weakening agent (e.g. Logan and Rauenzahn, 1987; Brown et al., 2003; Takahashi et al., 2007; Crawford et al., 2008). However, these previous studies are conducted with limited shear strain (mostly $<$10) in spite of significance of fabric development on weakening has been pointed out (Collettini et al., 2009). We thus performed large strain, friction experiments on graphite- and smectite-quartz bimineralic gouges using rotary-shear, low- to high-velocity friction testing apparatus to understand how frictional behavior changes with fraction and shear strain.

Experiments were done with dry and water-saturated conditions for graphite and smectite mixtures, respectively. Experimental results clearly indicated that the steady-state friction of the mixture gouge decreases exponentially with content of graphite/smectite (see figure); it starts to reduce at fraction of 5 vol% and reached to the almost same level of pure graphite/smectite at the fraction of $>$30 vol%. According to textural observation for the graphite mixtures, weakening of $<$28 vol% mixtures is associated with formation of slip-localized zone and development of graphite-lubricated, throughgoing slip surface with progressive shearing. On the other hand, $>$28 vol% of mixtures show diffused, graphite matrix flow within the slip-localized zone due to the development of graphite connection parallels to the Y- and P-surfaces. The relationship between strength versus graphite fraction evolves from early gentle to later abrupt sigmoidal curve with increasing shear strain (see figure). These trends are quite different from that of previous studies, and highlight the importance of shear strain and accompanied textural development on formation of weak fault.

[References]

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