

# Effects of normal stress on high-velocity friction of gabbro

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We performed a series of frictional melting experiments on gabbro at normal stresses to 6.5MPa to investigate the effects of normal stress on the frictional properties of rocks during frictional melting. Experiments were performed on a pair of hollow-cylindrical specimens of gabbro with outer and inner diameters of 25 and 16 mm, respectively, at constant slip rates to 1.6 m/sec. In the experiments, we slid specimens at a constant normal stress at about 1MPa firstly and the normal stress was changed gradually at an almost constant increasing rate when steady state of the friction during frictional melting was attained. Slip rate was maintained at a constant rate during a run. Experimental results revealed that frictional behavior changed at a critical normal stress toward higher normal stress conditions. Within low normal stress range, shear strength of the fault increased only slightly with the increase of normal stress. In the higher normal stress range, however, shear strength became obviously dependent on the applied normal stress. In the case of the result at a constant slip rate of 1.24 m/s, for example, this change of the frictional behavior appeared at about 2.5MPa. At low normal stresses, a molten layer separates sliding surfaces of steady state and the shear strength is determined by the viscosity and the strain rate of the molten layer. As normal stress increases, it is expected that the sliding surfaces comes closer and solid-solid contacts between the two surfaces appears to contribute to the bulk shear strength level. Observation of the texture of the fault tested at high normal stress under the microscope showed evidences of the contacting surfaces.

Maximum time duration of the presented melting experiments were limited by the total length of the paired specimens, because the total length of the specimens became short during frictional melting due to drop of the melt from the sliding surfaces. In order to examine whether a steady state friction was attained in the presented results, a series of experiments on a longer specimens is desired in the near future.