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Effect of dehydration reactions on the temperature of faults during coseismic slip

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Recent experimental and theoretical studies have emphasized the possible importance of mineral reactions during coseismic slip. Here we present a series of High Velocity Friction experiments on gypsum solid blocks, performed at Hiroshima University. The temperature close to the sliding surface and the relative humidity around the sample was measured during slip tests at 1.3 m.s^{-1}. The temperature on the sliding surface is remarkably stable during the dehydration reaction of gypsum. Microstructural investigations show that dehydration occurs at the very beginning of the test. Such reactions might be recorded within the wall rock by the presence of anhydrite crystal growth in the hottest parts of the sample. From a theoretical point of view at the fault scale, it is possible to include mineral dehydrations within the framework of Thermal Pressurization. Dehydrations are modeled as a source term for pore pressure because of the total volume change, and a sink term for temperature because they are endothermic. The solution is found numerically, taking into account fluid and heat transport and using an Arrhenius law to calculate the rate constant with temperature. The main effect of dehydration reactions is an increase of pore pressure and a stabilization of the temperature during slip, as illustrated by the HVE on gypsum.