The preliminary results of thermal effects on clay mineralogy and comparing with fault-related rocks of TCDP

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Abstract

To understand the frictional temperature and heat of earthquake, the mineralogical change of fault zone materials is the best candidate for it. The displacement of Chelungpu fault took place in the Chinshui Shale, which contains higher clay contents than neighbor formations. It, thus, might be suitable to discuss aforementioned questions via checking the reaction of clay minerals after heating. In this study we use materials from TCDP (1000m-1300m) which was identified as the Chinshui Shale and heat them with different temperatures in order to simulate the real product after high frictional heat by faulting. The aim is to realize the most important parameter of earthquake energies, temperature, via discussing the reaction of clay minerals after heating and comparing with fault zone materials from TCDP.

In this study we collected several samples between 1000m to 1300m to figure out the clay mineralogy of Chinshui Shale and heat host rocks with different temperatures: 600℃, 700℃, 800℃, 900℃, 1000℃, and 1100℃, respectively. The heating time was 5 minutes in high temperature furnace. We analyzed heated samples using X-ray Powder Diffraction (XRD) and Scanning Electron Microscopy (SEM) to realize mineral variations and phase changes. Meanwhile, we also heated pure illite by thermal gravimetric analyzer (TGA) with heating rate 200℃/minute. Based on the TGA data the melting temperature of pure illite was up to 900℃. Under SEM observations indicated that grains of minerals didn't change during the heating temperature from 600℃ to 900℃. When heating temperature was higher than 900℃, some melting phenomena have been detected from images of SEM, and many vesicles occurred by melting were observed over 1000℃. The results of XRD showed

that clay minerals were thermal decomposed over 900℃ and started melting. Comparing with TGA we found melting point of TCDP core was a little lower than pure illite. These preliminary results from heated materials of TCDP may provide us information for calculating the friction heat of the 1999 Chi-Chi Taiwan earthquake.