A consideration on friction experiments with synchrotron radiation towards unveiling earthquake generation processes

*Takehiro Hirose[1], Yoshio Kono[2]

1. Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology, 2. Geodynamics Research Center, Ehime, University

During large earthquakes, a fault moves with high velocity (>m/s), inevitably leading to generation of frictional heat on fault plane. The heat triggers a number of thermally-activated physico-chemical processes (gelification, melting, dehydration, and so on), whose products are responsible for coseismic fault lubrication (Di Toro et al., 2011). The products are likely formed instantaneously at the onset of coseismic faulting by non-equilibrium reactions. For example, Lee et al. (2017) observe that quartz undergoing coseismic faulting could melt at substantially lower temperatures than expected. They then suggest that the depression of the melting temperature is caused by metastable melting of β-quartz that could be transformed from α-quartz during the faulting. However, such a metastable phase which appears at moving micro-contacts with high temperature and pressure (i.e. asperity) are hardly confirmed without in-situ observation.

In order to confirm metastable micro-products formed during coseismic faulting and its mechanical impacts of fault, it is necessary to establish a high-velocity friction apparatus that allows to reproducing coseismic faulting at a synchrotron beamline. The friction apparatus for synchrotron micro tomography and X-ray diffraction studies of geomaterials will enable us to better understand the earthquake generation processes. In the presentation, we’d like to review the previous reports on dynamic processes in coseismic fault zones and introduce our thoughts of the future apparatus with synchrotron radiation.

Keywords: Earthquake, Friction, synchrotron

