# High pressure generation over 4 megabar and pressure scale issue

*Takeshi Sakai[1]

1. Geodynamics Research Center, Ehime University

The equation of state (pressure scale) of the reference material is necessary to determine pressures of high-pressure experiments. Many pressure scales have been proposed, but they are inconsistent, especially in the multi-megabar region, especially above the Earth's central pressure. Discrepancies in pressure scales yields uncertainties in the determination of the equation of state. For example, the equation of state of iron is important in discussing the composition of the Earth's core, but it is affected by the pressure scale problem at multi-megabar pressure, which corresponds to the Earth's core condition, and thus uncertainty in the equation of state leads to uncertainty in the estimation of the composition of the core.
Primary pressure scales have been proposed from *ab initio* calculations and/or shock compression experiments, but recently, pressure scales based on dynamic shockless compression (ramp compression) experiments have been reported. These are promising pressure standards in the extreme high-pressure region because they provide a more accurate isothermal equation of state since the effect of adiabatic compression is less and thus the contribution of thermal pressure is smaller. Although scales based on ramp compression have been proposed for Cu, Pt and Au, simultaneous compression experiments by static way are needed to confirm their mutual consistency.
The pressure generated routinely by conventional diamond anvil cells is limited about 300 GPa. To break through this limit, the double stage diamond anvil cell (ds-DAC) and the toroidal diamond anvil cell (t-DAC) have been developed as new alternative techniques. We have conducted simultaneous compression experiments in the 400 GPa region using t-DAC for various pressure scale materials such as Cu, Re, Pt, W, Au, and Fe. The mutual consistency of the equations of state for these materials will be discussed based on the static compression data.

Keywords: Toroidal diamond anvil cell (t-DAC), multi-megabar, equation of state (EoS)