Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PPS05-P01 Room:Convention Hall Time:May 25 15:30-16:45

Impact water release mechanism of antigorite

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Serpentine is present in primitive carbonaceous chondrites as well as in subducted oceanic crust and its dynamic behaviors play important role to understand the origin of planetary water. It is believed there were many collisional processes during the early planetary formation. Powdered samples of a natural serpentine (antigorite), encapsuled in steel containers, were subjected shock recovery experiments as a function of shock pressure and porosity. The degree of dehydration was estimated by thermal gravimetric (TG-DTA) analyses, powder x-ray diffraction (XRD) method, and transmission electron microscopy (TEM). The results indicate that the dehydration is sensitive to the shock pressure, porosity, and sample amount in the present study. Taking into account the shape of the recovered containers, the reaction is found to have occurred more violently in larger amounts of samples with higher porosity even at relatively low peak pressures. When degassing portion of water in the present experiments on powdered samples is compare with that for solid antigorite that was subjected in open space (Lange and Ahrens, 1980), the relationship between peak pressure and releasing water is almost identical each other in the pressure rage of 20-35 GPa. This implies that peak pressure plays a key parameter for impact degassing of serpentine. These results are applicable for understanding the origin of water on the planets including the Earth.