**Introduct**: The collisional disruption and re-accumulation of differentiated parent bodies in planetary accretion process play an important role to understand the origin of iron meteorites and M-type asteroids. Chronological measurements of differentiated meteorites by short-lived isotopic systems (e.g., $^{26}$Al-$^{60}$Fe) indicate that the differentiation process could occur at the early time in the solar nebula [1]. In this process, the differentiated bodies with metal core-rocky mantle could be experienced the collisional fragmentation and re-accumulation.

A lot of impact experiments and numerical simulations on homogenous rocky materials have been performed to simulate the collisional fragmentation of asteroids [e.g., 2, 3] whereas a small number of impact experiments and numerical simulations on core-mantle targets were conducted to study the effect of layered structure [e.g., 4, 5, 6]. However, there is shortage of previous works to clarify the impact fragmentation of metal core-rocky mantle targets simulating iron meteorite parent bodies. Thus, we conducted impact experiments on metal core-rocky mantle targets to study the collisional disruption and re-accumulation: We investigated the impact strength, the destruction mode and the fragment velocities of the core-mantle targets with various core/target mass ratios.

**Experimental Methods**: Impact experiments on the core-mantle targets were conducted by using a two-stage light-gas gun at Japan Aerospace Exploration Agency (JAXA). We prepared steel core-mortar (or gypsum) mantle targets to investigate the collisional fragmentation of metal core-rocky mantle targets. The mortar (or gypsum) spheres and steel spheres were also prepared to compare with the collisional outcomes of the core-mantle targets. Gypsum and mortar are usually used in impact experiments as a analog of asteroids and satellites. Steel is a good analog of iron meteorites cooled at the tempature of the asteroid belt [7, 8]. The densities of gypsum, mortar, and steel are 1200 kg/m$^3$, 1900 kg/m$^3$, and 7800 kg/m$^3$, respectively. Slurry gypsum or mortar was cast into a spherical mould with a steel sphere at the center to make the metal core-rocky mantle target: The targets were then dried for a few days at room temperature before the shots. The ratio of core mass to total target mass ($R_{CM}$) was changed to simulate the evolution of internal structure by thermal evolution. Head-on collisions were carried out between the nylon projectiles and the target in vacuum at a pressure less than 10 Pa. The impact velocities ($V_i$) were within 4 - 6 km/s. The collisional phenomena was observed by using a high-speed digital video camera at 3.2x10$^4$ frames per second.

**Results and Discussion**: We investigated the impact strength and fragment velocity to clarify the impact condition necessary to disrupt an iron meteorite parent body. The largest fragment mass normalized by the original target mass ($m_i/M_i$) is an useful parameter to show the degree of disruption [e.g., 9, 10]. We measured the $m_i/M_i$ of the core surrounded by mortar (or gypsum) mantle. The mean energy density required for the disruption of bare metal target ($Q_{metal}$) was $\sim$5x10$^4$ J/kg [8]. Meanwhile, the mean energy density required for the onset of the disruption was larger than $Q_{metal}$. This means that the effective energy density given into the core reduced by the energy absorption in the rocky mantle. We determined the boundary condition of the metal core disruption from the $m_i/M_i$ of the metal core:
The metal core disruption boundary can be determined from the impact strength of bare metal spheres and the energy fraction partitioned into the core.

The fragment velocity ($V_o$) at the antipode of the impact site has been investigated as a representative fragment velocity of the target. We measured the $V_o$ of the mortar, gypsum, steel spheres and the core-mantle targets to clarify the effect of the core-mantle structure. The $V_o$ of homogenous targets simply increased with an increase of the mean energy density whereas the $V_o$ of core-mantle targets increased with the increase of $R_{CM}$. This means that the impact energy partitioned into the mantle could be enhanced with the mantle mass reduction by the increase of the core mass. Using the $V_o$ of the core-mantle targets, we estimated re-accumulation condition of iron meteorite parent body. Therefore, we clarified the formation condition of iron meteorites from differentiated bodies such as Vesta.