Thermal-inertia estimation of asteroid (25143) Itokawa with the shape model

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The surface of a small asteroid is not considered that it is covered with a lunar-like sandy regolith. As the surface gravity of an asteroid is low, when a meteor collides with an asteroid, ejected fragments cannot stay on the surface. But (433) Eros is covered with a relatively thick fine-grained regolith (Lim,L.F et al.,2002). To examine whether the surface of an asteroid is covered with a sandy regolith or not, infrared and near infrared ground observations have been available. For their observations, the thermal inertia is unimportant parameter. And the important parameter that effects the change of surface temperature is the thermal inertia. Thermal inertia is the degree of resistance against heat flux. If a regolith covers the surface of an asteroid, the thermal inertia is low and the surface temperature changes rapidly. If bare rocks dominate the surface of an asteroid, the thermal inertia is high and the surface temperature changes slowly. Estimating the thermal inertia allows the surface thermal conditions of asteroids to be restricted.

In this study, we constructed a thermal model of Itokawa and find the suitable thermal inertia of Itokawa. And we also paid attention to HAYABUSA/XRS thermometer observations by means of deciding the surface conditions of Itokawa. This thermometer was attached to measure the temperature of HOOD by which the detectors of XRS were cooled passively. Since it was calibrated sufficiently in the thermal vacuum test, we found it is useful to investigate the temperature of Itokawa. At first we constructed a simple thermal model of Itokawa. The calculations of various values of the thermal inertia made the temperature changes and phase differences with the cycle of rotation. In this result, it is confirmed that as the thermal inertia increases, the degree of the surface temperature change is lower, the phase difference from the cycle of rotation is larger and the heat flows slowly. When we obtain the data of the temperature measurement that shows different thermal inertia, it is possible to estimate the most suitable thermal inertia. When we cannot obtain the data of the temperature measurement that shows different thermal inertia, it is possible to estimate the most suitable thermal inertia with the phase difference with the cycle of rotation. Therefore most suitable physical properties were estimated by different two methods. The shape model of Itokawa was taken into the thermal model to determine the value of thermal inertia more precisely. We will compare the surface temperature and thermal inertia from model calculation with those derived from XRS thermometer observation. The result will be reported in detail in this meeting.