The number of contact points and cohesive force of particles on small bodies

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Introduction:
The cohesive force of particles is important in a microgravity environment and affects the strength of rubble-pile asteroids and the mobility of particles on the surfaces of the bodies. The measured cohesive force of tens of micron-sized aggregates consisting of submicron-sized silica sphere monomers was about three times larger than theoretically predicted for the monomers (Nagaashi et al., JSPS fall meeting 2020). This suggests that the cohesive force depends not on the bulk size but on the constituent monomer size and the number of contact points and that tens of micron-sized aggregates would have three contact points under the Earth’ s gravity. However, small particles with sufficiently small gravity compared to cohesive force may contact with a surface at fewer points. In this study, to discuss the contact state of particles on small bodies we measured the cohesive force of several micron-sized meteorite fragments, which is smaller than that we previously used.
Experiments:
Allende meteorite fragments of tens of microns and several microns in size were deposited on a smooth stainless steel slide under the Earth’ s gravity, and the cohesive force of the fragments against the slide was measured by a centrifugal method at ambient condition. For several micron-sized fragments, the cohesive force was also measured after the fragments were pressed against a slide at a centrifugal acceleration of 80,000 G where G is the acceleration of the Earth's gravity.
Results and discussions:
The measured cohesive force of several micron-sized fragments was about one-third of that of tens of micron-sized fragments, while when pressed against the slide, the two became comparable. The increase of cohesive force of micron-sized fragments is considered due to increase of number of contact with the slide, i.e., from one to three. The contact state of particles on small body surfaces can be discussed by using the bond number *Bo* (e.g., Scheeres et al., 2010), which is the ratio of gravity to cohesive force per contact point. The Bond numbers are ~0.02, 0.01, and 0.00002 for tens of micron-sized meteorite fragments, aggregates, and several micron-sized meteorite fragments under the Earth’ s gravity, respectively. Since tens of micron-sized particles are likely to have three contact points, it is likely that particles larger than a millimeter on sub-km-sized airless bodies, where *Bo* is at least 0.01, are held to the surfaces at three points. This would be important for the mobility of particles and the structure consisting of particles on small body surfaces.

Keywords: cohesive force, contact point

