

## Collisional Growth and Fragmentation of Dust Aggregates with Low to Very High Mass Ratios

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For the process in forming planetesimals in protoplanetary disks, growth of dust aggregates through collisions between aggregates is important. However, in this process, high-velocity collisions cause collisional fragmentation and prevent aggregates from growing further. The critical velocity of collisional fragmentation is investigated in many previous studies, but especially in numerical simulations, the critical velocity was investigated only for cases with the mass ratio of colliding aggregates lower than 100. We carry out numerical simulations of collisions between icy aggregates with various mass ratios from 1 to 1024 and present the critical velocity of collisional fragmentation for mass ratios not presented in previous studies. Our simulation results show that the critical velocity for very high mass ratios is much higher than ones shown by previous studies and 100 m per second. On the other hand, for low mass ratios, it is suggested that the critical velocity is lower than half of the typical maximum collision velocity in the typical model of the protoplanetary disk. This tendency was not shown in previous simulations.