Shape-Dependent Oriented Meteorites: Insights From Trajectory and Surface Texture Analysis

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The formation of oriented meteorites is taken as our research theme that included investigating the shape dependent characteristic in their motion trajectory and surface texture. Three cameras with regular video were applied simultaneously to capture the motion of cone-shape objects with 6 different apex angles in three dimensional views. Experiments involves tracing the trajectories of cones with various apex angle to establish the correlation between the shape and the trajectory of oriented meteorites. By analyzing a limited number of known oriented meteorites, the results indicate that the cone with an apex angle of 35 degrees has great stability in descent process, as evidenced by its lower deviation angle and the number of flips when it falls freely in water compared to other cones with various apex angles, which reflected the meteorite's shape determines its motion trajectory after it passes through the atmosphere. For the testes of rock salt erosion by subsonic water flow that provided a comparison of "fish scale" texture to the known oriented meteorites shows good agreement. Using rock salt with irregular shape for erosion experiments which provided an experimental data support for the meteoroid ablation to formulate the qualitative explanation of the surface pattern of oriented meteoroid caused by aerodynamic heating, melting and ablating processes as it descends through the atmosphere. The present investigation of motion trajectory and the surface texture shows that erosion is correlated with the behavior of oriented meteoroids which is of particular importance for future studies of the relatively stable descent process of oriented meteorites typically falling with the apex downward.

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