Fitting the Chemical Ablation Model to Laboratory Experiments in Micrometeoroid Ablation

M. DeLuca (1,2), E. Thomas (2), Z. Sternovsky (1,2)
(1) Aerospace Engineering Sciences, University of Colorado, Boulder, CO 80309, USA, (2) Institute for Modeling Plasma, Atmospheres, and Cosmic Dust, University of Colorado, Boulder, CO 80309, USA
(michael.deluca@colorado.edu)

Micrometeoroid ablation experiments have been conducted using a gas chamber attached to the 3 MV hypervelocity dust accelerator at the Institute for Modeling Plasma, Atmospheres, and Cosmic Dust at the University of Colorado. These experiments measured charge production by the dust particle due to ablation along the particle's path in the gas chamber. They thus provide a rich dataset for the analysis of meteor ablation models. We used the data to evaluate the Chemical Ablation Model (CABMOD) developed by Vondrak, et al [1]. For our analysis, we focused mainly on ablation events in the 25-35 km/s velocity range, using a nitrogen atmosphere and dust particles less than a micron in diameter. We developed a Monte Carlo code to vary the different parameters in CABMOD to match the experimental data. The varied parameters include drag, the free molecular heat transfer coefficient, and β, the probability that an ablated meteoric atom is ionized through collisions with air molecules at a given velocity. Minimum fits between the model and the experiments were produced. The accuracy of CABMOD's heating and evaporation model is evaluated in light of the results, and compared to alternative models of meteoric ablation.

References

[1] Vondrak, T., Plane, J.M.C., Broadley, S., and Janches, D., Atmospheric Chemistry and Physics, Vol. 8, pp. 7015-7031, 2008.