Specific Heat Capacity of a Suite of Meteorites and Mineral Endmembers between 100 and 285K - Implications for Planetary Thermal Modeling

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Specific heat capacity (C_p) is one of the intrinsic thermophysical properties of planetary regolith controlling surface temperatures along with the albedo, density, emissivity, and bulk thermal conductivity. Although strongly temperature-dependent and poorly constrained below room temperature, $C_p(T)$ variations for various geologic materials are generally thought to be relatively modest, especially compared to other parameters (i.e., bulk conductivity). As a result, thermal modelers typically use lunar basaltic trends for $C_p(T)$, and ignore potential sources of variability stemming from compositional differences or shock metamorphism.

We investigate the validity of this assumption and present differential scanning calorimetry results for various minerals and meteorites, covering a wide range of compositions, bodies, and degrees of shock. For meteoritical materials, we confirm that $C_p(T)$ is predictable from the approximate knowledge of the mineralogical composition, and show that shock metamorphism does not seem to have any measurable effect. The behavior of carbonaceous materials may noticeably deviate from that of basaltic materials, and therefore modelers may want to use composition-specific $C_p(T)$ trends as opposed to basaltic.

A parametrization of the laboratory measurements (i.e., polynomial fits) for various materials and minerals will be presented and we will illustrate the rather limited impact of body-specific $C_p(T)$ for surface temperature modeling when compared to a standard lunar basalt assumption.

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