Laboratory Measurement for Thermal Conductivity of Granular Materials under Martian Atmospheric Pressure: Interpretation of the Daily Variation and the Low Value of Thermal Inertia at Arabia Terra

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We propose a new interpretation of the daily variation and the low value of thermal inertia at Arabia Terra on Mars.

To characterize the surface materials by remote sensing, thermal inertia is used a s an important parameter. Thermal inertia is defined by thermal conductivity, bulk de nsity and specific heat capacity. Especially thermal conductivity strongly affects on t hermal inertia. For terrestrial planets, it is covered with granular materials on the surf aces. Therefore, understanding of thermal conductivity of granular materials is a key in considering situations of planetary surfaces.

Thermal inertia calculated with the temperature obtained by remote sensing has daily variation and seasonal variation. *Putzig and Mellon* [1] suggested that surfaces with horizontal or vertical heterogeneity may yield apparent thermal inertia which varies with time of day and season. However, their interpretation couldn't explain the extent and the phase of the temporal variation of thermal inertia at Arabia Terra.

In addition, the value of thermal inertia is extremely low at Arabia Terra. Daytime thermal inertia at Arabia Terra can be under 20 tiu [1,2], which is lower than the value of thermal inertia of 1 micron dust (61 tiu [3]).

We performed experiments to measure thermal conductivity of granular materials which have different grain sizes and porosities under Martian atmospheric pressure. Based on the results of our measurements and previous measurements by many researchers (ex. [Presrey and Christensen, 1999] etc.) , we concluded that we cannot reproduct the temporal variation and the low value of thermal inertia at Arabia Terra with natural dry soils. We have to consider not only dry granular materials but also the condensation of the water at the surface of Arabia Terra to interpret the specific property of thermal inertia at Arabia Terra.

References

[1] N. E. Putzig and M. T. Mellon, *Icarus* **191**, 68 (2007).
[2] T. Saruya, T. Toyota, D. Baratoux, and K. Kurita, *41th LPSC*, 1306 (2010)
[3] M. T. Mellon, R. L. Fergason, and N. E. Putzig, *The Martian Surface, Cambridge University Press.* (2008).
[4] M. A. Presley1 and R. A. Craddock, *Jour. Geophys. Res.* **111**, E09013 (2006).