MODELING MAGNETITE REFLECTANCE SPECTRA USING HAPKE THEORY AND EXISTING OPTICAL CONSTANTS.

T. L. Roush[1], D. T. Blewett[2], and J. T. S. Cahill[2], [1]NASA Ames Research Center (Moffett Field, CA; ted.l.roush@nasa.gov), [2]Johns Hopkins University Applied Physics Laboratory (Laurel, MD).

Introduction: Magnetite is an accessory mineral found in terrestrial environments, some meteorites, and the lunar surface. The reflectance of magnetite powers is relatively low [1], and this property makes it an analog for other dark Fe- or Ti-bearing components, particularly ilmenite on the lunar surface. The real and imaginary indices of refraction (optical constants) for magnetite are available in the literature [2-3], and online [4]. Here we use these values to calculate the reflectance of particulates and compare these model spectra to reflectance measurements of magnetite available on-line [5].

Methods: The three available sets of magnetite optical constants were used in calculations of the bidirectional reflectance for comparison to the laboratory measurements of a 45-90 μm grain size fraction of magnetite (RELAB spectrum C2CS25) over the ~0.2-2.6 μm region. Hapke theory was used for the calculations and two different representations of the particle phase function were used: isotropic (Hapke's *b* and *c* are both set to 0) and non-isotropic (using an estimate from the results of [6] with *b* = -0.25 and *c* = 0.175). The results are shown in Fig. 1.

Summary: None of the available optical constants of magnetite closely reproduce the measured spectra regardless of the representation of the particle phase function (Figs. 1a, 1b). The calculated reflectances for two grain sizes are essentially the same (Fig. 1a, 1b). The calculated reflectances are significantly lower and the slopes shallower than the measured values (Fig. 1a, 1b). The non-isotropic phase function produces a lower reflectance than the isotropic phase function (Fig. 1c).

We will discuss the potential causes of the discrepancies between calculated and measured reflectances.

References: **[1]** Adams, J.B. 1974 in *Infrared and Raman Spectroscopy of Lunar and Terrestrial Minerals*, C. Karr Ed., Academic Press, New York, 109-116. **[2]** Querry, M.R, 1985, Optical Constants, CRDC-CR-85034, US Army Armament, Munitions, and Chemical Command, Aberdeen Proving Ground, MD. **[3]** Huffman, D.R. and J.L. Stapp 1973, *in Interstellar Dust and Related Topics*, J.M. Greenberg and H.C. Van de Hulst, Eds., IAU Symposium 52, 297-301. **[4]** Triaud, A., www.astro.uni-jena.de/Laboratory/OCDB/mgfeoxides.html. **[5]** www.planetary.brown.edu/relabdocs/relab_disclaimer.htm. **[6]** Mustard, J.F. and C.M. Pieters 1989 JGR, 94, 13,619-13,634.

Acknowledgements: We are grateful to funding from NASA's PDART program in support of this work.

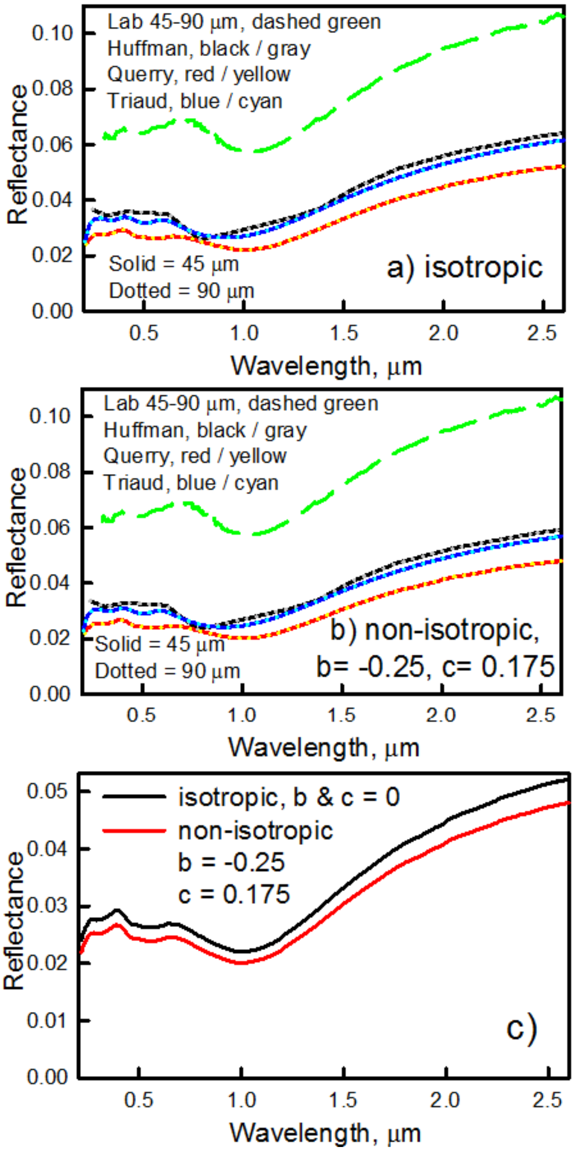

Figure 1. Laboratory reflectance of a 45-90 μm magnetite sample (RELAB, C2CS25), compared to calculations of the reflectance using Hapke theory assuming particle phase functions of a) isotropic b) non-isotropic, using scattering parameters from [6] and c) direct comparison of 45 μm grain size calculations for isotropic and non-isotropic phase functions.