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Reflectance spectra of particulate mixtures in the near and medium infra-red spectral range: part I.

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The Hapke theory of reflectance should allow to deduce at the same time composition, relative abundance and grain size of each component of planetary regolith. This theory was experimentally tested up to 2.5 μm. Recently there have been several space missions to Mars with on board spectrometers, such as TES, OMEGA, PFS and CRISM, operating in the near and medium infrared spectral range (beyond 2.5μm) and the analysis of such amount of data is problematic and slow. In the present work we shall report our recent activity in laboratory simulation of simple regolith, aimed to the analysis of the mixing laws, concerning different grain sizes and materials, in the whole spectral range of interest (2.5 $\div$ 25.0 μm). In fact, without an appropriate theoretical framework, it is difficult to derive reliable information from spectral observations of planetary surfaces, supposed to be widely covered by intimate mixtures of different particulate minerals. For these reasons we have tested this theory making some hypotheses aimed to ease its application; in particular we assume: (1) identical particles; (2) isotropic scattering and (3) extinction efficiency normalized to the incident energy. Our work was developed comparing experimental and theoretical reflectance spectra of particulate mixtures. For the laboratory activity we used a carbonate (dolomite) sample for its importance as marker for liquid water on Martian surface, an olivine sample, because it is present on Martian surface, and a quartz sample because it is well studied. The grain sizes were selected according to the assumptions about the

Martian regolith (100-200 μm), but we chose also bigger and smaller grains in order to check the influence of grain sizes on the behaviour of reflectance spectra of minerals mixtures.

Our tests demonstrate that this theory is valid beyond 2.5 μm, up to the first restrahlen band of one of the components; we also demonstrate that the hypotheses of isotropic scattering and identical particles are valid in the whole observed spectral range. The latest findings of our research are reported in a companion paper (Fonti et al., this conference).