POST-ACCRETION HISTORY AND REFLECTANCE SPECTROSCOPY PROPERTIES OF THE MUKUNDPURA METEORITE.

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The Mukundpura meteorite fell on Earth on June 6, 2017 [1] and has been classified as a CM2 chondrite. The meteorite was recovered quickly after its fall, and offers the possibility to investigate the optical properties of an extremely fresh carbonaceous chondrite. In this work, we first characterize the bulk mineralogy and derive the nature and extent of parent bodies processes experienced by Mukundpura using a combination of Raman spectroscopy, transmission IR spectroscopy and thermo-gravimetry (TGA). Then, the reflectance spectra of Mukundpura were measured in the 0.4-4 μm range in order to investigate the absorption features of the fresh CM2 chondrite, as well as their dependence on observation geometry.

Transmission IR spectroscopy reveals that the mineralogy of this sample is dominated by phyllosilicates. There was no detectable olivine signature observed in the SiO_4 stretching area around 11.2 μm, and this is in agreement with the TGA results showing a mass loss of 12.5 wt. % in the 200-770°C range [2]. The order of its polyaromatic carbonaceous matter as assessed by Raman spectroscopy. The obtained spectra exhibiting the Raman D- and G-bands and the derived spectral parameters show that Mukundpura is a primitive CM2 chondrite having escaped any significant heating (radiogenic and shock-related metamorphism) [3].

Reflectance spectroscopy of Mukundpura shows the typical spectral absorptions detected in CM chondrites [4-5]. The sample has a low reflectance factor (2.8% at 0.55μm), a strong phyllosilicates absorption band at 2.75 μm due to Mg-OH, as well as bands at 0.7 μm together with weak features at 0.9 μm and 1.1 μm. The Mukundpura spectra also show a faint but detectable organics band at 3.4 μm and point to the presence of CH_2 and CH_3 functional groups. In order to investigate the dependence of these absorption features with observation geometry, bidirectional reflectance spectra were collected for 70 different configurations from nadir to grazing illumination and emergence, in and out of the principal plane. These data reveal an increase of reflectance at low phase angle, reaching 7.6% at a 10° phase angle compared to a reflectance of 2.2% at a 70° phase angle. We also observe a well pronounced spectral reddening with the phase angle, the ratio between the reflectances at 2 μm and 0.5 μm reaches 1.8 with an illumination angle of 60° and a phase angle of 130°. The presence of both backward and forward scattering behaviors is interpreted as a high dispersion of grain size [6]. The phyllosilicates bands do not show significant variations upon geometry, but the organics absorption band at 3.4 μm is deeper at grazing observation angle (70°) with a nadir illumination (0°).

The fresh Mukundpura meteorite spectraly behaves as a classical CM2 chondrite. Temperature dependencies of the reflectance spectra will be investigated, as well as the comparision of the bidirectional reflectance distribution function of Mukundpura to other CM meteorites.

[1] Ray D., Shukla A. (2018) *Planetary and Space Science* 151:149-154. [2] Garenne A. et al. (2014) *Geochimica et Cosmochimica Acta* 137:93-112. [3] Quirico et al. (subm.) *Geochimica et Cosmochimica Acta*. [4] Garenne A. et al. (2016) *Icarus* 264:172-183. [5] Cloutis E.A. et al. (2011) *Icarus* 216:309-346. [6] Pommerol A., Schmitt B. *Journal of Geophysical Research* 113:E12008.