EFFECTS OF PARTICLE SIZE AND PHASE ANGLE ON VISIBLE AND NEAR-INFRARED REFLECTANCE SPECTRA OF CARBONACEOUS CHONDRITES.

T. Hiroi[1], R. E. Milliken[1], and C. M. Pieters, [1]Department of Earth, Environmental and Planetary Sciences, Brown University, Providence, Rhode Island 02912, U. S. A. (takahiro_hiroi@brown.edu).

Introduction: Among carbonaceous chondrites (CCs) CM chondrites are the most abundant group and may be the major component of the near-Earth asteroids such as 162173 Ryugu to be visited by Hayabusa2 spacecraft in 2018. As was the case with asteroid 25143 Itokawa visited by Hayabusa spacecraft, the surface of a small asteroid such as Ryugu may consist of abundant boulders and gravels. Therefore, it is important to study the effects of particle size as well as viewing geometry such as phase angle on reflectance spectra of CM chondrites in order to identify their parent bodies among small near-Earth asteroids.

Experimental: In this study, two sets of CM chondrite samples (ALH 84040/4 and MET 00630/9) were chosen for their similarities (probable pairing) in each set based on their proximity and spectral similarity, and a stark difference between the sets. Each sample group was prepared into a chip, a fine powder (<125 μm) and a coarse powder (125-500 μm) through grinding and dry sieving. Bidirectional reflectance spectra of these CM chondrite samples were obtained at 15, 30, 45, and 60 degree incidence and 0 degree emergence angles at every 10 nm over the range of 320-2550 nm relative to Spectralon which is close to a Lambertian (an isotropic) reflector. The obtained spectra were corrected for the reflectance of Spectralon using the RELAB proprietary calibration table. Each sample was spun during the measurements. The field of view was about 5.6 mm on each sample surface.

Preliminary Results: Plotted in Figs. 1 and 2 are the reflectance spectra and the effects of phase angle on some key parameters. The 700 nm band strength (BS_{700}) using simulated Hayabusa2/ONC-T (Optical Navigation Camera – Telescopic) bands was calculated as: $BS_{700} = lnR_{700} - (160\ lnR_{550} + 150\ lnR_{860}) / 310$, where R_λ denotes reflectance over an ONC-T band at λ nm in wavelength. In Fig. 1 both phase reddening and bluing are observed, and in Fig. 2 overall the 700 nm band becomes stronger as the phase angle increases.

Acknowledgment: Meteorite samples were kindly loaned from NASA Johnson Space Center or Smithsonian National Museum of Natural History. Reflectance spectra were measured at RELAB, Brown University. Part of this research was supported by JSPS KAKENHI grant number 24540493 and NASA SSERVI to T. H.

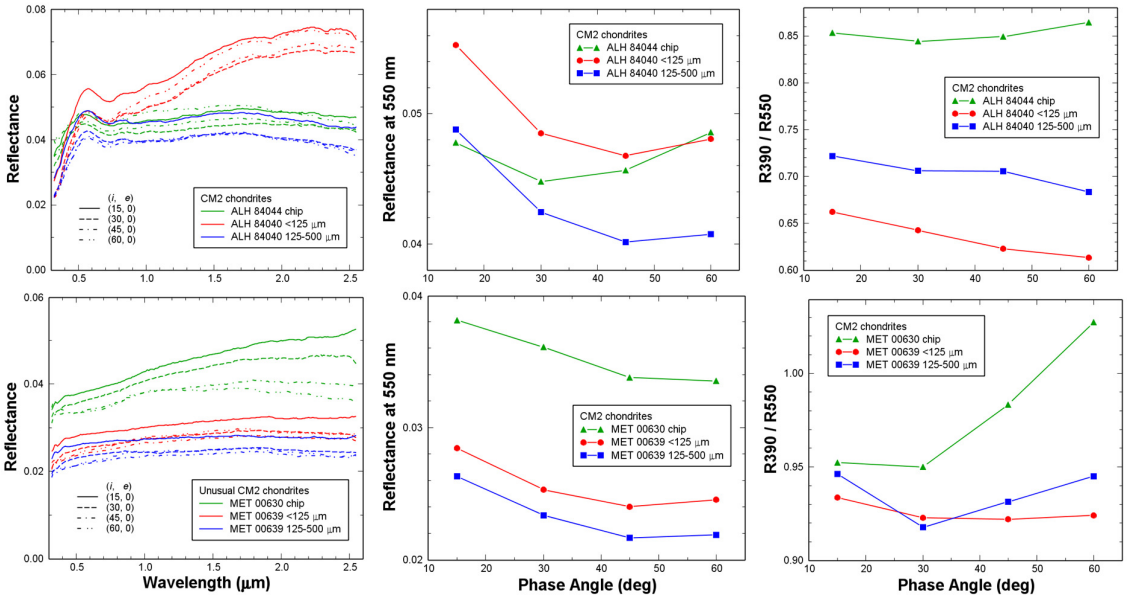

Fig. 1. Reflectance spectra of two sets of CM chondrite samples (ALH 84040/4 and MET 00630/9) in chip, fine powder, and coarse powder forms, and the effects of phase angle on their visible brightness and UV-visible colors.

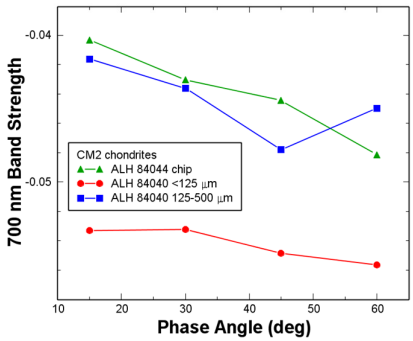

Fig. 2. Effect of phase angle on the 700 nm absorption band strength of ALH 84040/4 CM chondrite samples.