

**SPATIAL DISTRIBUTION OF ORGANIC MATTER IN THE BELLS METEORITE USING NEAR-FIELD INFRARED MICRO-SPECTROSCOPY.** Y. Kebukawa<sup>1\*</sup>, S. Nakashima<sup>1</sup>, K. Aizawa<sup>2</sup>, T. Inoue<sup>2</sup>, K. Nakamura-Messenger<sup>3</sup> and M. E. Zolensky<sup>3</sup>. <sup>1</sup>Department of Earth and Space Science, Osaka University, 1-1 Machikaneyama, Toyonaka, Osaka 560-0043, Japan. <sup>2</sup>Jasco Co., Ltd, 2967-5 Ishikawa, Hachioji, Tokyo 192-8537, Japan. <sup>3</sup>Astromaterials Research and Exploration Science, KT, NASA Johnson Space Center, Houston, TX 77058, USA. \*E-mail: yoko.soleil@ess.sci.osaka-u.ac.jp.

**Introduction:** Fourier transform infrared (FTIR) micro-spectroscopy is useful for characterizing both organic and mineral structures. However, its spatial resolution is limited to ~10  $\mu\text{m}$  at maximum [1]. Near-field infrared (NFIR) micro-spectroscopy has recently been developed to permit infrared spectral mapping beyond the optical diffraction limit with a spatial resolution of several hundred nanometers [2]. This method is expected to measure nondestructively the distribution of specific organic polar functional groups including C-O, C=O, aliphatic CH<sub>3</sub>, and CH<sub>2</sub>, together with those for minerals.

Here we apply this new high-resolution NFIR micro-spectroscopy to the analysis of organic matter in the Bells meteorite (an unusual CM2 chondrite), which is one of the most primitive chondrites by their isotopic compositions [3], in order to elucidate spatial distribution and microscopic characterization of organic matter.

**Results and Discussions:** NFIR spectral mapping of the Bells 300 nm thick ultramicrotome sections on Al plates for several  $\mu\text{m}^2$  areas showed ~1  $\mu\text{m}$  aliphatic C-H rich areas which were considered to represent the organic rich areas. Heterogeneous distributions of organic functional groups as well as those of inorganic phase such as silicates (Si-O) were observed with less than 1  $\mu\text{m}$  spatial resolution. One of the aliphatic C-H rich portions (~1  $\mu\text{m}$ ) in other slices of Bells may contain C-O bonds.

NFIR measurement on Al plate method also enables us to obtain organic and inorganic features of chondrite samples which are too small and thin to obtain spectra by conventional FTIR. Hence, NFIR is expected to be a powerful tool for small astronomical samples such as interplanetary dust particles (IDPs) and mission returned samples. The NFIR imaging method can provide submicron spatial distribution of organic functional groups and their association with minerals.

**References:** [1] Nakashima S. et al. 1989. *Geochemical Journal* 23: 57-64. [2] Kuya N. et al. 2004. In *Physicochemistry of Water in Geological Systems*, edited by Nakashima S. et al. Tokyo, Japan: Universal Academy Press. pp. 179-187. [3] Alexander C. M. O'D. et al. 2007. *Geochimica et Cosmochimica Acta* 71: 4380-4403.