FLUORESCENT DYE HANDLING SYSTEM FOR MELOS1 LIFE DETECTION MICROSCOPE M. Nishizawa[1], S. Sasaki[1], A. Miyakawa[2], E. Imai[3], Y. Yoshimura[4], H. Honda[3], T. Sato[5] and A. Yamagishi[2]. [1]School Bioscience Biotechlol., Tokyo Univ. Technol., 1404-1 Katakura, Hachioji, Tokyo 192-0982, Japan. E-mail:sasaki@stf.teu.ac.jp. [2]Tokyo Univ. of Pharm. and Life Sci. [3]Nagaoka Univ. of Tech. [4]Tamagawa Univ. [5]JAXA-ISAS.

Introduction: Unlike other missions [1], one of the goals of the MELOS1 mission is to find life directly on Mars. To fulfill this purpose, observation of potentially existing cell images will be performed using a microscope. To distinguish 1 micro-m sized cells from sand particles, fluorescent dyes are planned to be used together with an excellent fluorescent microscope. Use of different types of dyes that can stain nucleic acid, cell membrane, or protein-like molecules will be used. Detection of a wide variety of organic compounds would be able using the same method.To operate unmanned microscopic observation on Mars, one bottleneck would be the handling of dye solution. Concerning the temperature and pressure on Mars, choice of dye solvent and the way of its supply to the collected sample sand should be carefully performed. Here we report the method of dye solution supply onto the sampled sands. Effect of material property (wettability) on solution dropping will also be reported.

Solvent for dyes: Ethyleneglycol and methanol are widely used material to promote antifreezing property of a water-based solution. As measurement of enzymatic activity is planned in MELOS1 mission, they are not suitable because they might cause denaturation of some proteins. Choice of biochemically friendly materials was selected.

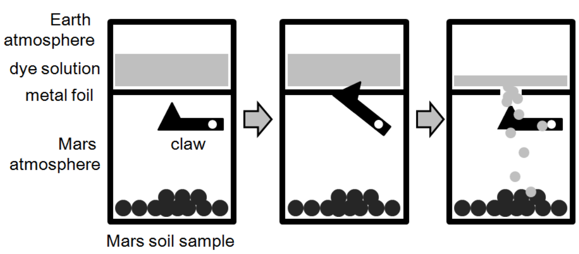

Fig. 1 Schematic illustration of dye solution handling method..

Dye solution handling method: After sampling the Mars sample sands by the use of robot arm of the rover, sample cuvette will be sealed. The cuvette will then separated by the metal foil with the dye solution-capsule that contains Earth atmosphere (100 kPa). A claw will rip the foil and the solution will drop over the sampled sands (Fig. 1). Drop behavior of the solution depends on the foil wettability, surface tention of the solution, thickness of the solution, of the pressure difference between the two spaces.

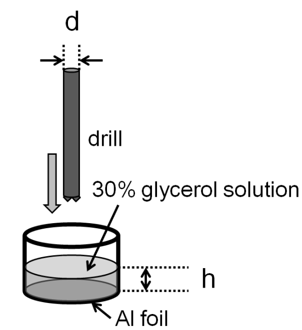

Fig. 2 Experimental setup

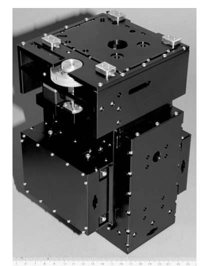

Fig. 3 Microscope

Experiment: As a first step, we examined the effect of foil wettability and the hole size on the drop behavior. A cuvette with an Al foil at the bottom that contained a 30% glycerol solution of fixed thickness was used (Fig. 2). Drills with different diameter were used to make a hole into the foil. Al foil was used with and without the boehmite treatment [2]. As a result, behavior of the 30% glycerol solution was almost the same with water. Boehmite treatment worked effectively from the solution dropiing viewpoint. Together with the behavior of water on aluminum surface under a reduced pressure [3], an optimal method for the dye handling will be discussed. Design and performance of a newly designed microscope system (Fig. 3) will also be reported.

References: [1] Atreya S. K. 2007. Planet. Space Sci. 55: 358-369. [2] Hart R. K. 1953. Trans. Faraday Soc. 50: 269-273. [3] Sefiane K. 2004. J. Colloid Interface Sci.15: 411-419.