

火星環境下におけるグリセロール溶液の挙動 Behavior of glycerol solution under Martian environment

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Microscopic detection of possible bacterial cells on Mars using life detection microscope (LDM) is planned in MELOS (Mars Exploration for Living Organisms) project. One candidate solution for the fluorescent dyes is 66.7% glycerol. Under Martian atmosphere, evaporation of water from the solution is expected. Estimation of evaporation flux and resulting behaviors (mass change, cooling, convection, bubbling etc.) should be essential for the design of sample handling system (SHS) and imaging procedure. Observation of solution mass change, convection, bubbling of the solution sealed in the 7 hPa chamber was performed. Convection was analyzed from the thermographic images. Measurement of water activity was also performed with and without the model sand samples. Following results were obtained: (1) Glycerol concentration changed after water evaporation. Freezing temperature should, therefore, increase and solution freezing might occur. The amount of evaporated water depended on the hole diameter of the sealing cap, indicating that even incomplete sealing was effective. (2) The solution showed heterogenous density distribution as a result of evaporation. Convection, which was unfavorable for the image capturing, due to the nonuniform density was observed. (3) Sand attached-water showed various water activity, which changed according to the material and size of the sand particles.

The 66.7% glycerol solution containing fluorescent dyes also successfully stained cultured bacteria, organic materials, and microorganisms in Martian soil simulant and natural environmental samples. We also developed the formula and conditions to preserve the fluorescence pigment before and after landing on Mars and during the microscopic observation.

Reference

M. Nishizawa et al. (2013) Fluorescent Dye Handling System for MELOS1 Life Detection Microscope. In International Astrobiology Workshop 2013, p. 47. LPI Contribution No. 1766, Lunar and Planetary Institute, Houston.

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