| Project title | **Study on ice/water sensing technology by development of the small Imaging Spectrometer** |

Institutions：Sentencia Corporation and Osaka University

Research outline

Objective

Various types of two-dimensional imaging spectrometers with different methodology exist；however, each has limitations in the reduction of weight and size. A major objective for this study is to develop a hardware model with a considerably reduced size and weight using a method with less restrictive conditions. In FY2016, we optimized the optical system for this purpose, examined the driver system, surveyed the detector, and optimally designed and prototyped a portion of the optical components.

Contents

1) Optical system design and size optimization, and frame and structure of the entire system. We conducted surveys and selected a detector. We optimized the equipment arrangement and optical path using optical design, and examined the frame size. We targeted a size/shape of ~200 mm square, with final target dimensions of 90 × 150 × 100 mm. The system has built-in optical components (e.g., diffraction grating), detectors, and drive mechanisms, which are not motorized and driven manually.

2) Study and prototyping of optical components. We optimized the design and prototype of the diffraction grating. Based on the optical design, we conducted an examination and an optimization study of the diffraction grating, and then created a prototype. We verified the spectral performances and incorporated them into the BBM optical system, the primary prototype.

3) Examination of the spectroscopic functionality and performance required in lunar and planetary exploration. We prototyped a cooling stage to examine the required functionality and performance for lunar and planetary exploration, and then simulated and observed the ice formation on lunar and planetary surfaces.
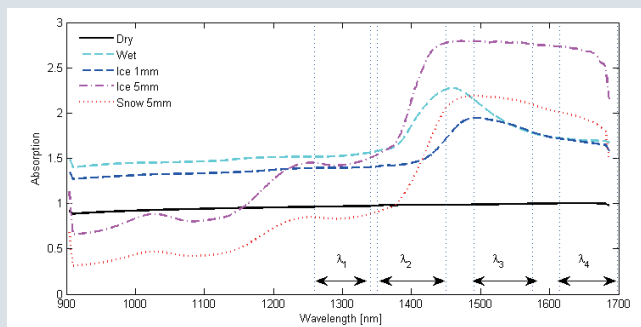
Patrik Jonsson, et al., 2014, Road Condition Imagimg-Model Development
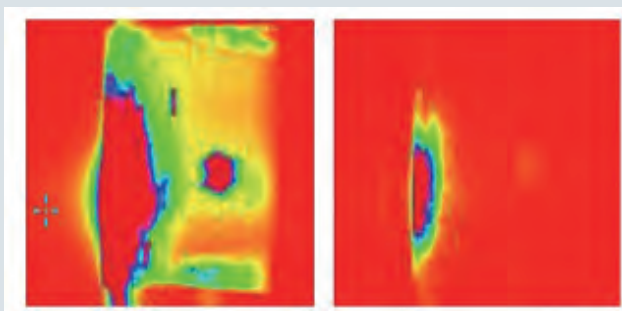
1290nm   1370nm

Reflectance images of water and ice surface at different wavelengths

An instance involving the use of two-dimensional spectroscopy to distinguish between surfaces covered in water, ice, and snow (here, measured by Sentencia).