

BL43IR Infrared Materials Science

1. Introduction

BL43IR is dedicated to infrared microspectroscopy in the wavenumber region from 10000 cm^{-1} to 100 cm^{-1} . The beamline has three microscopes: a high spatial resolution microscope, a long working distance microscope, and a magneto-optical microscope. The microscopes are used with a Fourier transform spectrometer. We are developing new instruments for microspectroscopy not only as countermeasures against deterioration of equipment already in operation but also to recruit new users for various sample environment.

2. Replacement of the CCD observation system

We had five CCD cameras for beam alignment in the upper part of the beamline light path. Figure 1 shows the camera locations. The CCD camera shown is connected to a power supply/signal I/O

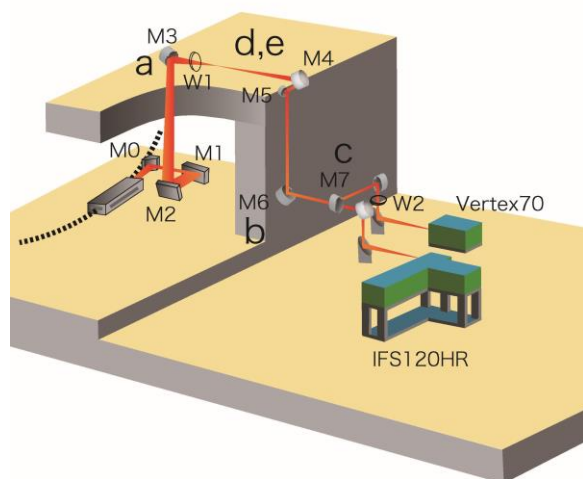


Fig. 1. CCD cameras for mirrors (a, b, c) and for direct observation of light (d, e). M: mirror, W: window.

(Fig. 2(a)) and a signal switcher (Fig. 2(b)). The system is approximately 20 years old. Some of the devices malfunctioned, and were replaced with new components in FY2019. Figure 2(c) shows the camera that was replaced with an easy-to-replace availability. The signal I/O switcher was also replaced with one that provides the necessary and sufficient functions (Fig. 2(d)).

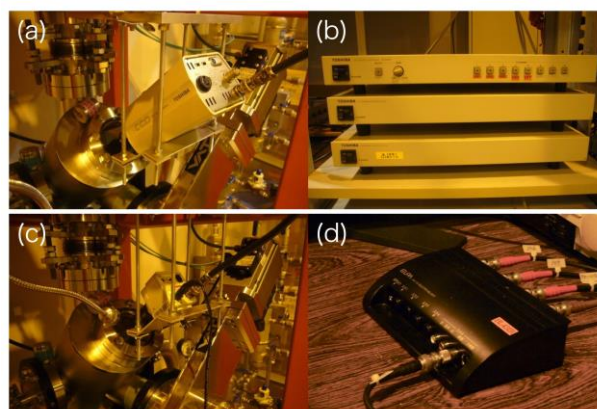


Fig. 2. (a) Old and (c) replaced observation CCD camera and (b) old and (d) replaced camera-related components.

3. Replacement of the Hyperion microscope power supply

The Hyperion observation light was abruptly cut off and the optical setting was unexpectedly rebooted. This was conceivably due to an unstable light bulb, which could be solved by replacing it. However, further investigations revealed that the issue was due to an unstable power supply. The power supply was replaced with a spare one, and now all the optics are functioning correctly. Figure 3 shows the location of the power supply for the microscope.

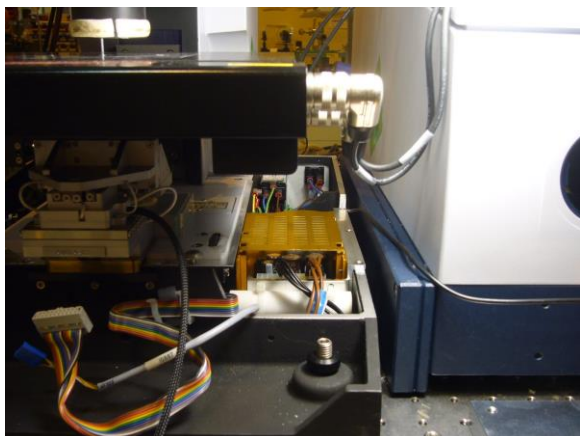


Fig. 3. Power supply for the microscope, which is located at the center of the image, was replaced in FY2019.

4. Humidity control cell

To perform infrared microspectroscopy measurements under humidity control conditions, a humidity control cell was developed in FY2018 with reference to [1]. It was used in many user experiments and contributed user expansion. In FY2019, the cell was modified to increase the feasibility of the high-humidity region.

Figure 4(a) shows a schematic illustration of the cell. In an experiment, a small amount of sample was placed on a BaF₂ substrate and inserted into the humidity control cell. The cell had a BaF₂ window to pass infrared light. The atmosphere in the cell was controlled by a mixing device (RIGAKU model HUM-1E), which mixed N₂ gas (99.99%, generated by a KOFLOC model MNT-0.8SI nitrogen gas generator) and water vapor at the specified ratio. The water used in the mixing device was purified through a Millipore model Elix Advantage-3 Water Purifier. The humidity-controlled gas was transported through a copper pipe to the cell from the mixture device. In the higher humidity region,

the water vapor was adsorbed by the pipe but the humidity in the cell remained below about 80%. The red line in Fig. 4(a) shows the path.

To prevent water vapor adhesion, the pipe was wrapped with a ribbon heater and mildly heated. Figure 4(b) shows a photograph of the cell with the heater wrapped around the pipe. With this modification, the humidity in the cell could be raised up to 98%. Consequently, this setup makes it possible to observe new phenomena in the high humidity region.

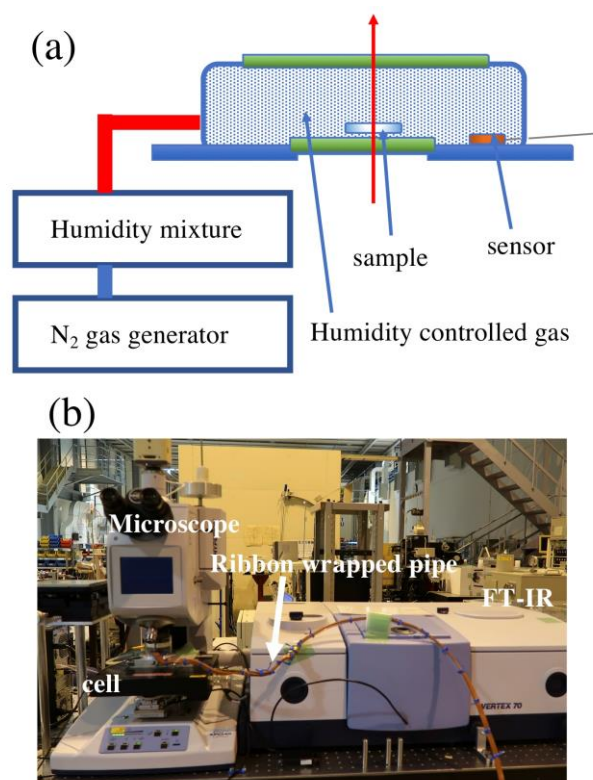


Fig. 4. (a) Schematic illustration of the cell and (b) photograph of the cell with the heater wrapped around the pipe.

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Reference:

- [1] Baba, S., Hoshino, T., Ito, L. Ito & Kumasaka, T.
Humidity Control and Hydrophilic Glue Coating
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