Soft X-ray microscopic image at cryo temperature

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Soft X-ray microscope is expected to be one of the promising tools for observing living cells with nm order resolution. We have developed and installed a cryogenic sample chamber system to the X-ray microscope since our aim is also to observe living cells with the X-ray microscope. The design concept of the cryogenic system is based on the X-ray microscope station of BESSY I [1]. The cryogenic system has been designed for observing bio-specimens at temperatures between 273 and 110 K [2]. The first X-ray imaging of biological specimen in cryogenic chamber was done with NIH3T3 cell. However it was quite different from the shape of the cell observed with the light microscope because the image field was vibrated during cooling operation [3]. The shift/vibration of the sample was caused by the severe cryo-gas leakage from a gap between the cryo-house and airlock thermal insulation block [3]. By sealing of the gap, the order of the shift/vibration was drastically reduced. As the second X-ray imaging of biological specimen, we observed paraffin-embedded non-stained mouse spleen. The measured images are shown in Figs. 1. As compared with (A), (B) shows good preservation of external form and size of cells. Although cells of different types are observed under light microscope, cells of different types are not observed under X-ray microscope. In addition, any intracellular structures cannot observe it in the cell. In order to observe the intracellular structure with 50 nm resolution, a thermal drift rate of the sample stage should be less than 1 nm/s.

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To achieve about 1 nm/s, we will introduce a new cryogenic sample stage.

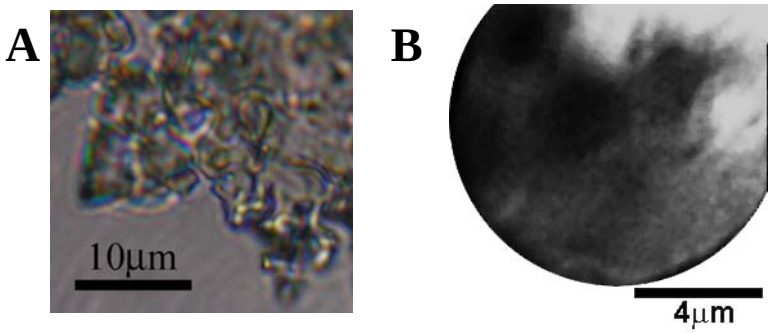

Fig.1 Light and X-ray micrographs of a paraffin section of mouse spleen. (A) was taken with light microscope at room temperature and (B) was taken with X-ray microscope at 233 K. Wavelength was 1.9 nm. Exposure time was 1 min. Observed area of each image was different.

References

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