Low Energy-Electron-Excited X-ray Microscopy

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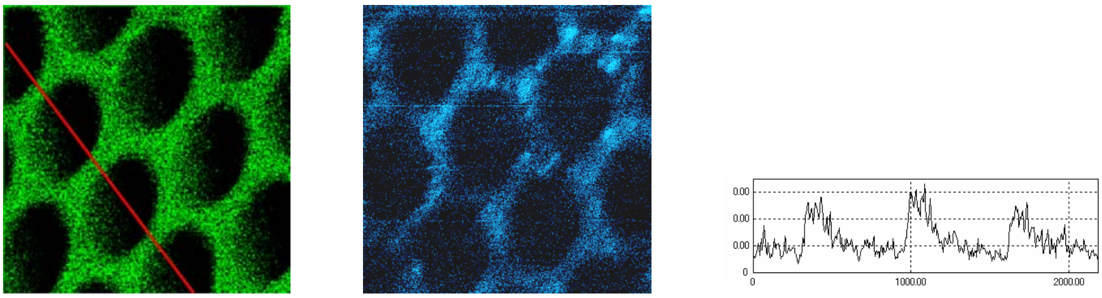
Recently a development of low-energy X-ray microscope have been desired having a spatial resolution of 100 nm in order to investigate living bodies. While a low-energy X-ray microscope using X-ray laser generated by multi-ionization has not yet been accomplished. Very recently a low-energy electron-excited X-ray microscope has been developed by Ueda[1]. When a low energy electron irradiates a specimen surface, X-ray is generated as “bremsstrahlung” and valence band excitation up to few tens electronvolts.

In order to separate the X-ray from secondary electrons and emitted ions for X-ray imaging, a time-of-flight techniques have been adopted where a primary electron beam is pulsed with 220 ns pulse-width. Pulsed primary electron is scanned on the surface. A repetition of pulse beam irradiation accumulates X-ray signal intensity from one position as a pixel for imaging. Since whole signals excepting reflected electron are measured in a TOF spectrum, X-ray image and ion-images are obtained simultaneously from the same position as shown in a figure shown below. Fig.(a) is X-ray image from microchannel plate of which hole diameter is 12 μm, and (b) hydrogen image on the same surface. Fig.(c) is a line profile of X-ray intensity on the oblique line on fig.(a).



(a) (b) (c)