X-ray spectroscopy captures signals from single atoms

Improved sensitivity realized single atom identification

We have developed a high sensitivity X-ray detector and demonstrated the detection of the characteristic X-ray signals from single Er atoms in energy dispersive X-ray spectroscopy. The intensities of Er *L* and *M* lines from a single Er atom were extremely weak in contrast to the *N*-edge of electron energy-loss spectroscopy, which implies the intrinsic difficulty to sense single atoms in X-ray spectroscopy. Nevertheless, this work will certainly ensure the possibilities to obtain X-ray spectra from single atoms and to identify single atoms in the sample.

Kazutomo SUENAGA
Nanotube Research Center
suenaga-kazu@aist.go.jp

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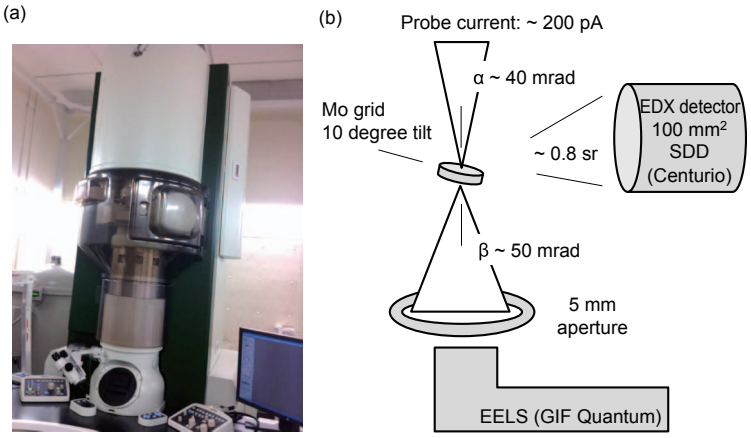

(a) The developed analytical microscope (at Kyushu University) and (b) the schematic of the experiment

Utilization of slow positrons under atmospheric conditions based on a microbeam technique

To realize in-situ evaluation of intermolecular spaces in functional thin films

We have developed a controlled-environment positron probe micro-analyzer. This system can be used with the positron annihilation lifetime technique to evaluate open spaces such as atomic- and molecular-level defects, holes, and pores of functional thin films in an ambient gas at atmospheric pressure, i.e., in conditions which are close to the actual working environment. In this system, positrons are generated in a vacuum and formed into a focused, short-pulsed beam with low, variable energy. The beam is extracted via a thin vacuum window into the atmosphere, and then injected into the film sample, so that the positrons stop near the surface. By using this system, nondestructive evaluation of the intermolecular spaces for a polymer thin film with a thickness of a few hundred nanometers in nitrogen gas with controlled, variable, relative humidity has been achieved.

Nagayasu OSHIMA
nagayasu-oshima@aist.go.jp
Research Institute of Instrumentation Frontier

Kenji ITO
k-ito@aist.go.jp
Metrology Institute of Japan

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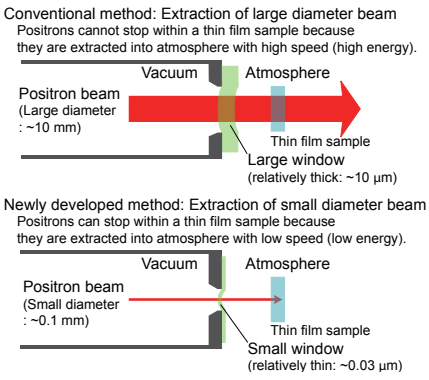

Schematic of the method used to extract the slow positron beam into the atmosphere