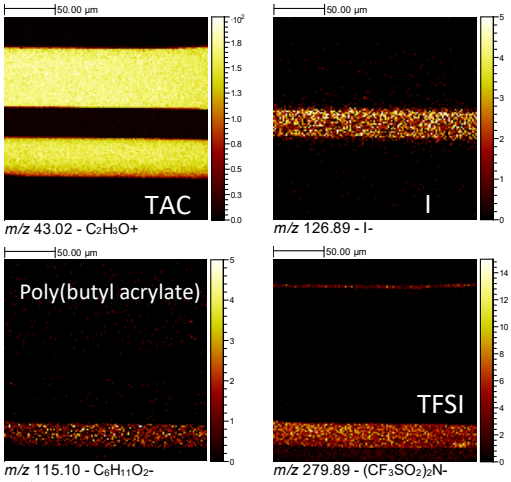
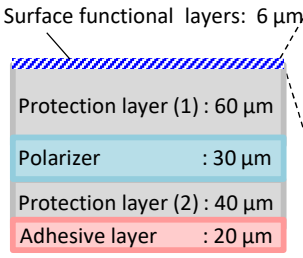
Qualitative analysis of surface functional layers on optical film by GCIB-TOF-SIMS

GCIB (gas cluster ion beam)-TOF-SIMS provides us depth distribution of organic components with depth resolution of several nanometers. Qualitative analysis of thin surface functional layers of optical films, which is difficult on cross-sectional imaging, was successfully carried out.

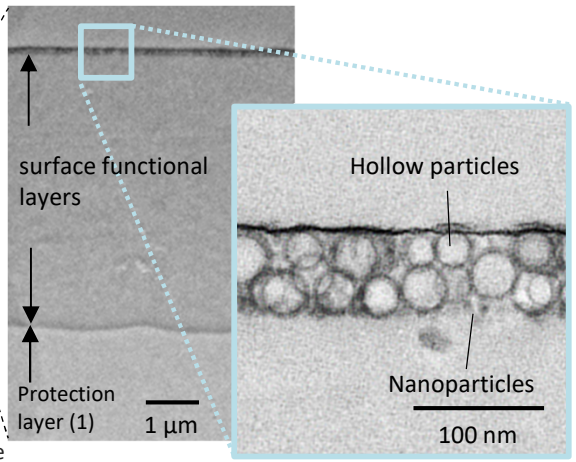
TOF-SIMS imaging of cross-section of Optical film





TAC: Triacetylcellulose
TFSI: Bis(trifluoromethanesulfonyl)imide

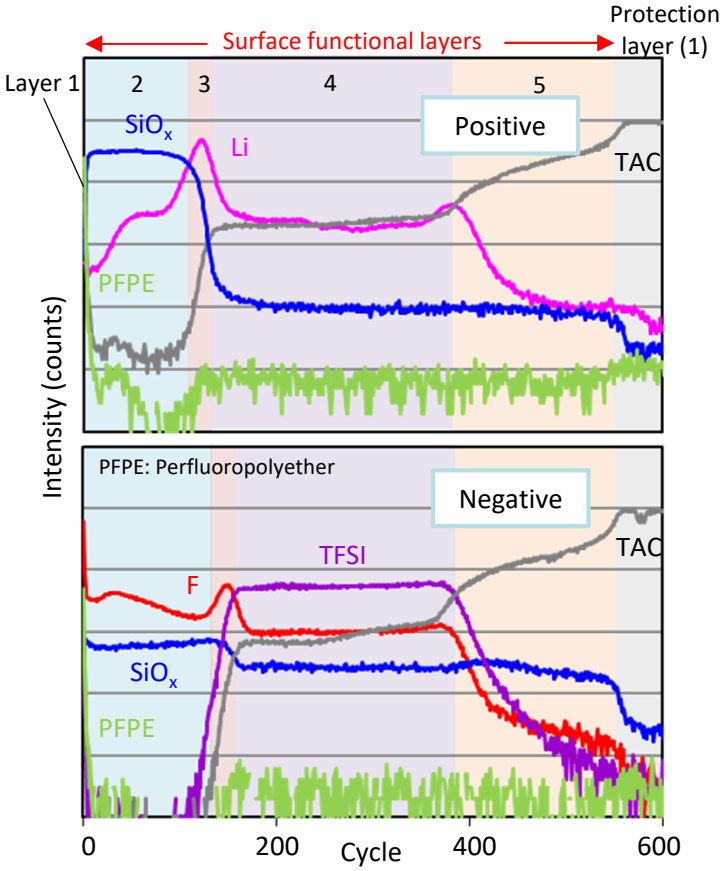
TEM images of surface functional layers



◆ 5-layer structure was observed in TOF-SIMS cross-sectional imaging of optical film. It consists of surface functional layers including TFSI, protection layers (1) (2) of TAC, polarizer including iodine, and adhesive layer of acrylic polymer.

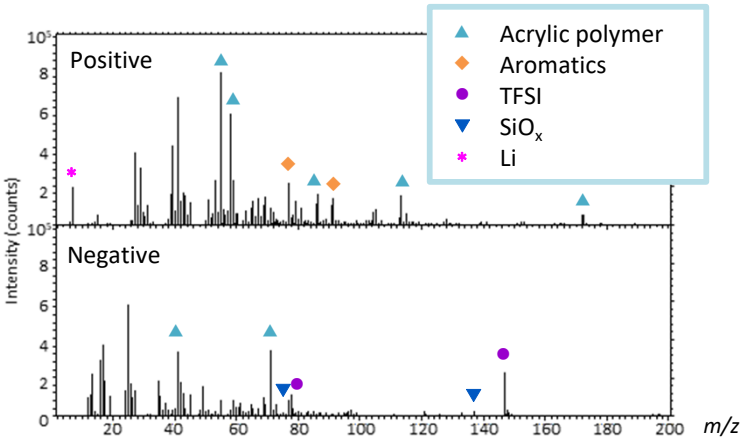
◆ Hollow particles and nanoparticles were observed on the most surface of optical film in TEM observation, which are reported to be used as anti-reflection layer.

GCIB-TOF-SIMS depth profiling of Surface functional layers



◆ GCIB-TOF-SIMS depth profile reveals 5-layer structure of surface functional layers. From the correspondence with TEM images, layer 2 of silicon oxide and layer 3 including Li and F are considered to be hollow particles and nanoparticles, respectively.

◆ On depth profiling analysis, mass spectra of each depth cycle is obtained. Mass spectra of layer 4 (200 - 300 cycle) is shown below. Layer 4 consists of acrylic polymer including quaternary ammonium structure, aromatic polymer, etc.



◆ Layer 5 consists of components of layer 4 and protection layer (1). This layer may suppress interference fringes caused by difference of refractive index between layers.

GCIB-TOF-SIMS depth profile reveals precise information of layer construction and composition of surface functional layers, which were not distinguished in cross-sectional TOF-SIMS images and TEM image.

Toray Research Center, Inc.