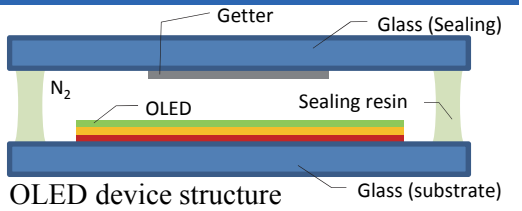
Sealing capability measurement using isotope marker

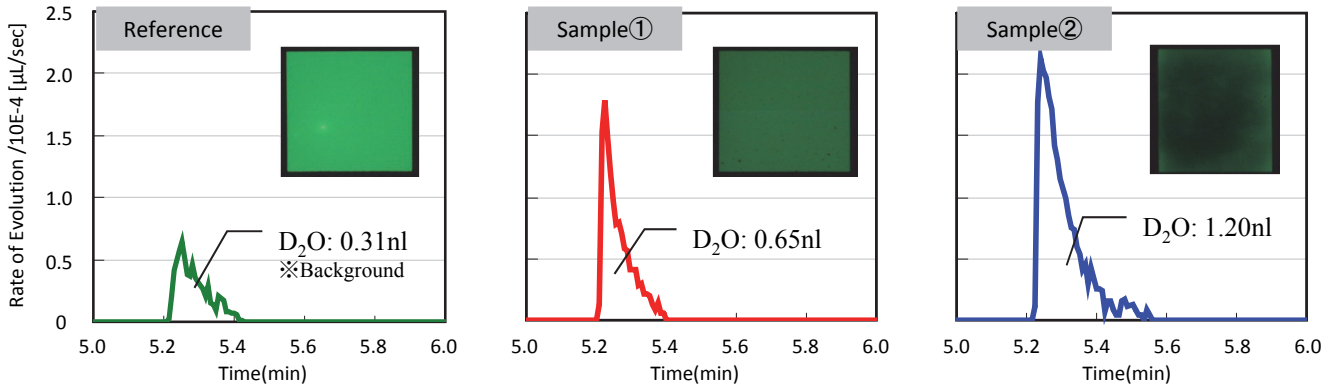
OLED devices, filled with N2 gas and sealed by glass and sealing resin, were forced to deteriorate by immersion into heavy water at 80 °C for a few days. We performed sealing capability measurement on them using TPD-MS and SIMS.



OLED device structure

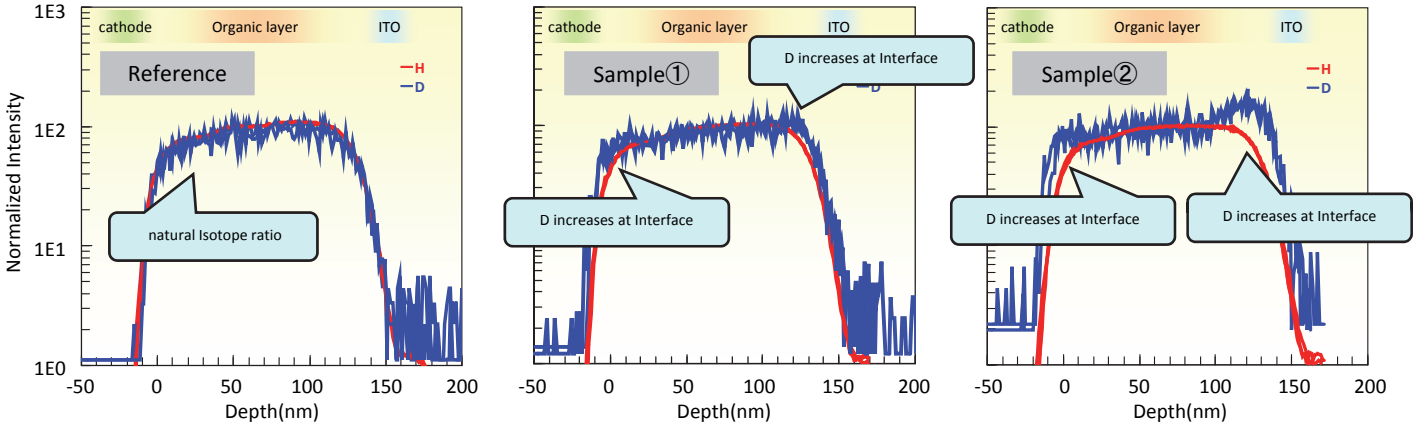
Heavy water content in sealed gas（TPD-MS）

Analysis of sealed gas in OLED devices were carried out by TPD-MS. The gas generation rate curves of *m/z*=20 corresponding to D_2O and the photographs of light-emission of three samples of different degree of deterioration in brightness are shown below. It was found that the quantity of D_2O in the sealed system has correlation with the degree of the deterioration.

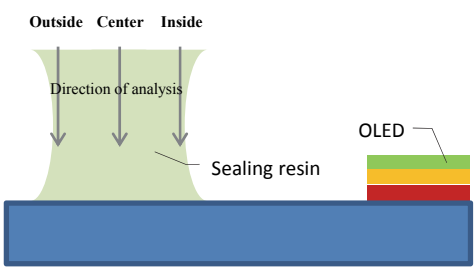


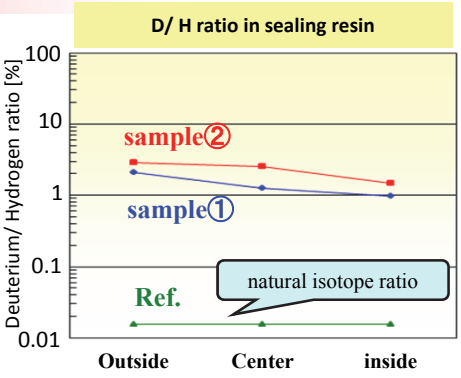
Deuterium distribution in OLED (D-SIMS)

Depth profiles of several elements were obtained for the samples above. Because the hydrogen concentration in the organic layer is high, some deuterium is considered to originally exist before heavy water penetration. However, the quantity of deuterium tends to rapidly increase at the interfaces between the cathode and organic layer and between the organic layer and anode, depending on the degree of the deterioration.



Deuterium penetration into sealing resin (D-SIMS)





To investigate the penetration path of D_2O into the system, the sealing glass was separated forcibly from sealing resin and the quantity of D in sealing resin at separation surface was measured by D-SIMS. We found the concentration gradient of D in the sealing resin from outer to inner sides of the device, depending on the degree of the deterioration. From this result, we conclude that D_2O penetrated into the system through the sealing resin.