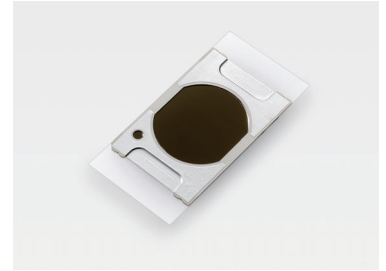


DIUTHAME-MSI of a polymer material by mist extraction method using a humidifier

Polymer materials are lightweight, easily molded, and essential to our daily lives, but they deteriorate easily due to an oxidation reaction. In particular, a polyolefin-based polymer such as polypropylene (PP) tends to have this problem. Therefore, several kinds of stabilizers are used in combination, and their distribution in the polymer is also an important factor in preventing deterioration. This paper reports the DIUTHAME-MSI (mass spectrometry imaging) of the distribution of light stabilizers (HALS) in a PP sheet, by a mist extraction method using a humidifier. The extraction solvent was a mixture of methanol and a cationizing agent, potassium iodide (KI). Using the mixed solvent and the mist extraction method maintains position information and avoids MSI degradation because the optimal amount of solvent can be supplied uniformly to the entire sample's surface.

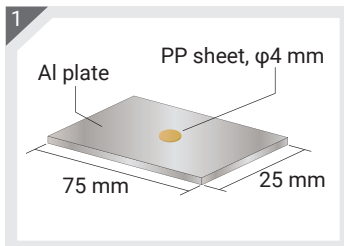


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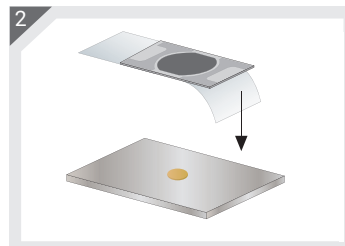
Measurement conditions

- Measurement mode: Laser pitch 250 μm
 Positive ion, spiral mode
 Sample: Light stabilizer (HALS, Adekastab LA-68) 5.0 wt% in PP sheet, ϕ 4 mm, about 30 μm thick
 Extraction mist: Potassium iodide (KI) 1 mg/mL in methanol, 0.01 mL/s, 30 seconds
 Container: 140 mm X 70 mm X 30 mm

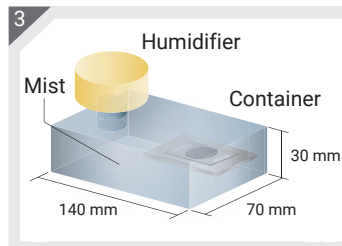
Method



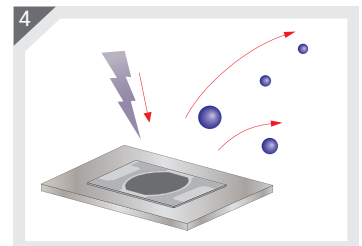
Attach a PP sheet on an Al plate with conductive double-sided tape.



Place a DIUTHAME on the PP sheet.



Expose to mist for 30 seconds in a container. Mist supplied by a humidifier.

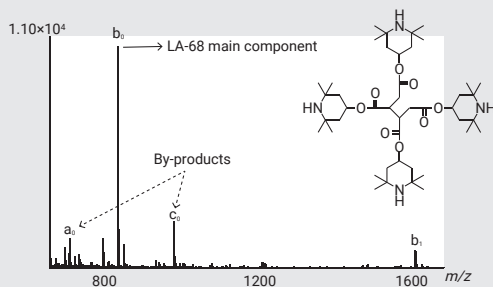


Start measurement after the sample dries.

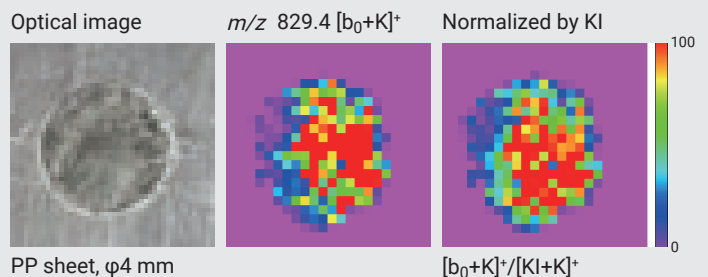
Results

Using DIUTHAME, the mass spectrum and MSI results of LA-68 in the PP sheet are shown below. Potassiated molecules were strongly observed by mixing KI as a cationizing agent. The MS image shows that the mist extraction method using a humidifier resulted in a uniform distribution, and the MSI dispersion could be reduced by normalizing with $[\text{KI}+\text{K}]^+$. These results suggest that the mist extraction method using a cationizing agent can provide high signal intensity and uniform MSI for dry samples.

Mass spectrum of LA-68 in PP sheet



MS image of LA-68 $[\text{b}_0+\text{K}]^+$ in PP sheet



Measurements were performed in collaboration with the Ohtani Lab, the Department of Life Science and Applied Chemistry, Nagoya Institute of Technology.

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