EGA thermogram of degraded high impact polystyrene

<Correlation with Xe weather meter test>

[Background] UV-degraded high impact polystyrene (HIPS), reported in PYA5-003E, was analyzed using evolved gas analysis (EGA)-MS. The correlation between the results obtained with the micro UV irradiator and those obtained with a conventional Xe weather meter was investigated.

[Experimental] 10 µL of a dichloromethane solution of HIPS (2 mg/mL) was placed in a sample cup (two side openings) and irradiated for 30 min, 1 hour, and 12 hours using the micro UV irradiator at a furnace temperature of 60ºC in air. EGA was performed. In the Xe weather meter experiments, the HIPS plate was irradiated for 100 and 300 hours. At 100 and 300 hours the portion of the surface was scraped off and 20 µg was used for the EGA.

[Results] When a HIPS sample is irradiated for 1 hour using the micro UV irradiator, the peak apex decreases 10ºC, and the onset of pyrolysis decreases from 360 to 300ºC. Furthermore, the peak becomes broader. Also, size-exclusion chromatography reveals that the average molecular weight decreases from 285,000 to 240,000, indicating that the polymer's main chain is degraded. A second HIPS sample was irradiated for 300 hours using a Xe-weather meter. The peak apex decreases by 14ºC and the onset of pyrolysis decreases from 360 to 280ºC. The HIPS thermograms obtained after irradiation using the micro UV irradiator and the weather meter are almost identical. The micro UV irradiator provides comparable data to that obtained using a weather meter in much less time. More polymer formulations can be quickly evaluated which not only reduces the cost/sample but encourages polymer formulators to evaluate a larger number of polymer possibilities, perhaps leading to the discovery of a polymer with novel characteristics.

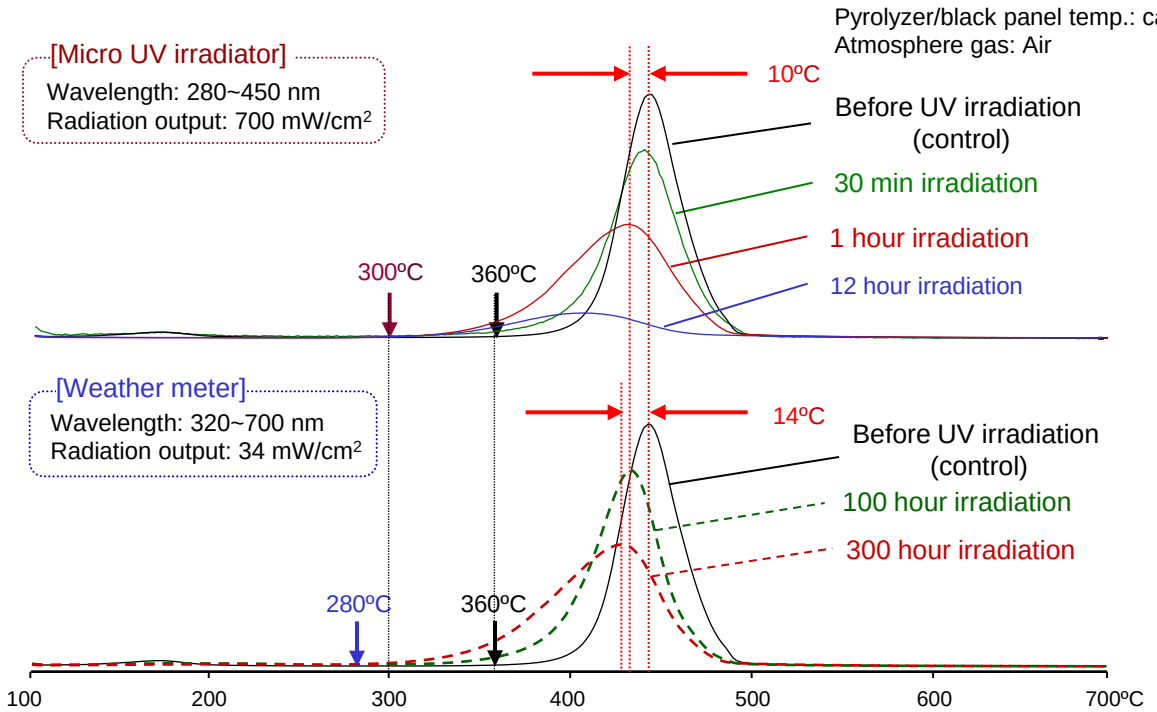

Fig. 1 Thermograms obtained before and after irradiation by UV/Py-GC/MS (top) and Xe weather meter (bottom).

Pyrolyzer temp.: 100 - 700ºC (20ºC/min), GC oven temp.: 300ºC, UADTM-2.5N (L=2.5 m、i.d.=0.15 mm)
Carrier gas flow rate: 1 mL/min; He, split ratio: 1/50, sample:20µg

Keywords : HIPS, micro UV irradiator, weather meter, EGA, thermogram, photo/thermal/oxidative degradation

Products used : Multi-functional pyrolyzer, Micro-UV Irradiator, Vent-free GC/MS adapter, Deactivated metal capillary tube

Applications : Weathering tests

Related technical notes : PYA5-003E

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