

# Multi-Sample UV Irradiator

## - Part 2 Comparison of degradation degree by sample cup position -

**[Background]** The on-line UV irradiation (UV)/pyrolysis (Py)-GC/MS system consists of a Micro-UV Irradiator (UV-1047Xe) directly interfaced to a GC/MS instrument. The system is used for the photo/thermal/oxidative degradation of polymeric materials, and it can also be used for on-line analysis of volatile degradation products released during UV irradiation. However, only a single sample can be run at a time. A new Multi-Sample UV Irradiator (UV-1048E) was developed to allow multiple samples to be irradiated simultaneously (Fig. 1). This note describes whether the degradation degree by UV irradiation depends on the sample location in the cup holder, or not.

**[Experimental]** 5  $\mu$ L each of dichloromethane solution (20  $\mu$ g/ $\mu$ L) of high impact polystyrene (HIPS) was put in sample cups and the solvent was evaporated to form 100  $\mu$ g HIPS film on the inner surface of the cup. Five sample cups were placed in holes on either the inner or outer circumference of the holder. The holder rotates during the 6 hours UV irradiation. The irradiation distance from the tip of the fiber bundle to the sample cup was 100 mm. The samples were analyzed using a Multi-functional pyrolyzer (EGA/PY-3030D) in the evolved gas analysis-MS (EGA-MS) mode.

**[Result]** EGA thermograms of HIPS, measured at both the inner and outer circumferences, with and without UV irradiation are shown in Fig. 2. The peak width of the thermograms after UV irradiation is wider than that obtained from a sample without UV irradiation. The reason for the change in peak width can be attributed to structural alterations of HIPS, *i.e.*, oxidation and polymer chain scissions. When the peak widths of the thermograms of samples placed at the inner and outer circumferences are compared, there are almost no differences. In addition, the reproducibility (RSD) of the peak widths at 10% of the peak height was 1.15% (6 hrs irradiation,  $n=5$ ) for samples placed at the outer circumference. As described above, the degradation degree caused by UV irradiation is almost the same for the samples located on either the inner and outer circumferences, suggesting that the UV light uniformly irradiates each sample as the sample holder rotates.

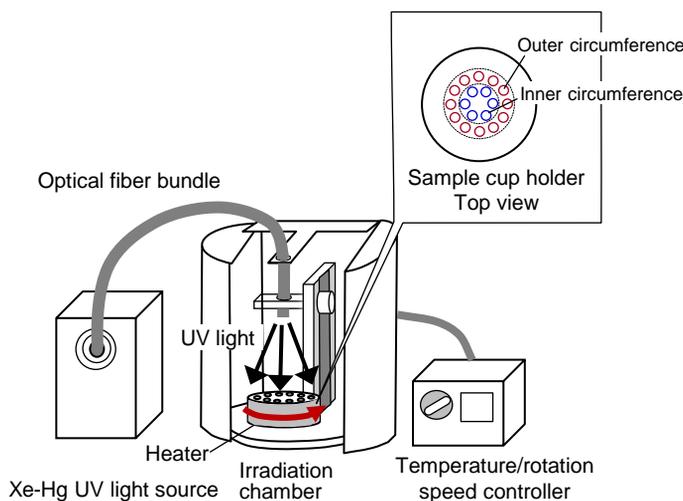


Fig. 1 Three components of Multi-Sample UV Irradiator

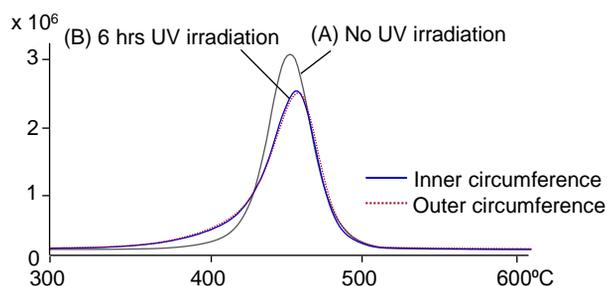


Fig. 2 EGA thermograms of HIPS with and without UV irradiation

- ▶ UV irradiation      Sample cup holder temp.: 60°C, Atmosphere gas: air, Sample cup holder rotation speed: 0.3 rpm, Irradiation distance: 100 mm
- ▶ EGA-MS analysis      Furnace temp.: 100 - 600°C (20 °C/min), Deactivated metal tube: L=2.5 m, i.d.=0.15 mm, Column flow rate: He 50 mL/min, Split ratio: 1/50

Ref. Technical notes [PYA5-001E](#), [PYA5-005E](#), and [PYA5-006E](#).  
[C. Watanabe et al., Polym. Degrad. Stab., 94 \(2009\) 1467-1472.](#)  
[T. Yuzawa et al., Polym. Degrad. Stab., 96 \(2011\) 91-96.](#)  
[K. Matsui et al., Polym. Test., 56 \(2016\) 54-57.](#)

**Keywords :** Photo/thermal/oxidative degradation evaluation, Accelerated degradation, HIPS

**Products used :** Multi-Shot Pyrolyzer, Multi-Sample UV Irradiator, Micro-UV Irradiator, Deactivated metal capillary column

**Applications :** Weathering test

**Related technical notes :** [PYA5-007E](#), [PYA5-009E](#)

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