

Multi-Sample UV Irradiator

- Part 3 Correlation with Micro-UV Irradiator -

[Background] This note describes the results on the UV degradation of high impact polystyrene (HIPS) measured by both a Multi-Sample Irradiator (UV-1048E) and a single sample irradiator (UV-1047Xe).

[Experimental] 5 μL each of dichloromethane solution of HIPS (20 $\mu\text{g}/\mu\text{L}$) was put in several sample cups. The solvent was evaporated to form a thin film of HIPS (100 μg). Five cups were irradiated simultaneously using the Multi-Sampler UV Irradiator and another five cups were irradiated sequentially using a single sample Micro-UV Irradiator. After UV irradiation was completed, each cup was analyzed using evolved gas analysis (EGA)-MS (EGA/PY-3030D, Frontier Laboratories).

[Result] The EGA thermograms of HIPS obtained after irradiation are shown in Fig. 1. Note that as the irradiation time increases, the peak width increases in both irradiator systems, indicating that the degradation degree of HIPS depends on the irradiation time. Fig. 2 shows that changes in the peak width at 10% of the peak height are dependent upon the irradiator systems. The rate of degradation using a Micro-UV Irradiator is six times faster than that obtained using a Multi-Sample Irradiator due to the closer irradiation distance; however, there is a strong correlation between the two. The reproducibility (RSD) of the peak widths was examined for the HIPS samples, which were placed in different holes on the outer circumference of the sample holder, and the RSD value was 4.3% or less ($n=5$) for the 0 - 12 hrs irradiation time. As shown above, the Multi-Sample Irradiator allows for efficient degradation which can be well correlated to that obtained using a single sample Micro-UV Irradiator.

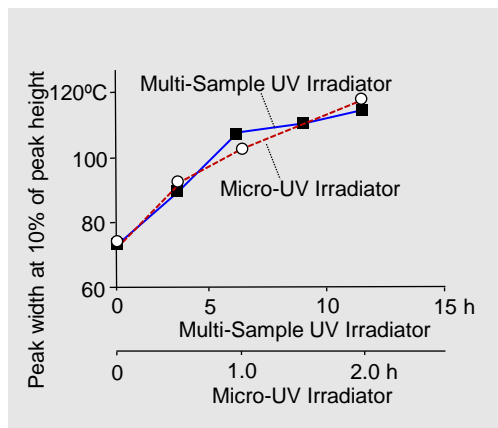
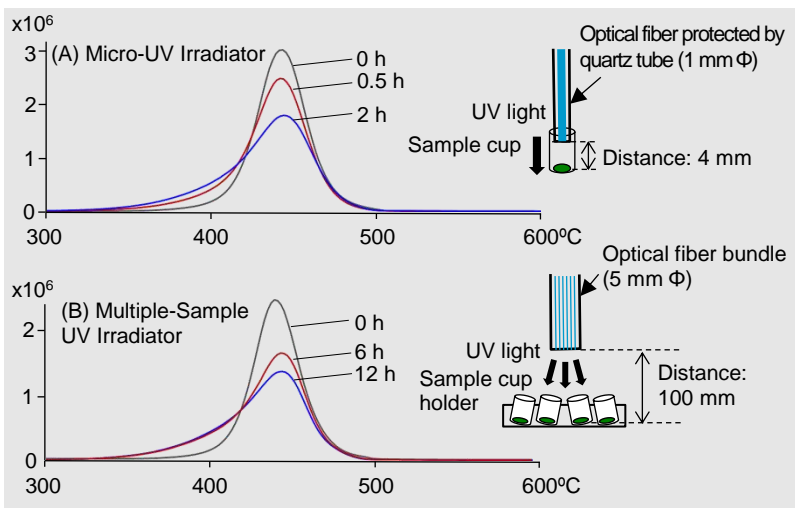


Fig. 1 EGA thermograms of HIPS irradiated by (A) Micro-UV Irradiator and (B) Multi-sample UV irradiator

- ▶ UV irradiation Sample cup holder temp.: 60°C, Atmosphere gas: air, Sample cup holder rotation speed: 0.3 rpm
- ▶ EGA-MS 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

Fig. 2 Peak width at 10% of the peak height of EGA thermogram of HIPS vs. UV irradiation time

▶ UV light irradiation and analytical conditions are identical to those described in Fig. 1.

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-functional pyrolyzer, Multi-Sample UV Irradiator, Micro-UV Irradiator, Deactivated metal capillary column

Applications : Weathering test

Related technical notes : [PYA5-007E](#), [PYA5-008E](#)

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