

Analysis of the photo/thermal/oxidative degradation products formed when high impact polystyrene (HIPS) is UV irradiated

[Background] High impact polystyrene (HIPS) is a polystyrene (PS) / rubber copolymer. Because of its enhanced impact strength, it is extensively used in TV, printer cabinets, etc. Outdoor exposure tests and weather meter tests are used to evaluate the polymer's stability; however, these techniques preclude the analysis of volatiles released during the degradation. This note reports the analysis of the volatiles emanating from HIPS when it is exposed to UV radiation using the Frontier UV irradiator. The micro UV irradiator was used with a xenon (Xe) lamp.

[Experimental] 10 µL of a dichloromethane solution (2 mg/mL) of HIPS was placed in a sample cup. The sample was irradiated using the micro UV irradiator for 1 hr at 60°C in air. Volatile degradation products were cryo-trapped by immersing the head of the separation column in liquid nitrogen. Upon the completion of UV irradiation, the air was purged from the system using helium and the irradiated sample was thermally desorbed (60→250°C). The column was then removed from the liquid nitrogen and GC/MS analysis of the trapped vapors was conducted.

[Results] Fig. 1 shows the chromatograms of the volatile degradation products from HIPS with and without UV irradiation. Benzaldehyde, acetophenone, and benzoic acid are the PS degradation products formed during the irradiation. 2-propenal is also observed. All identifications are based upon mass spectral data.

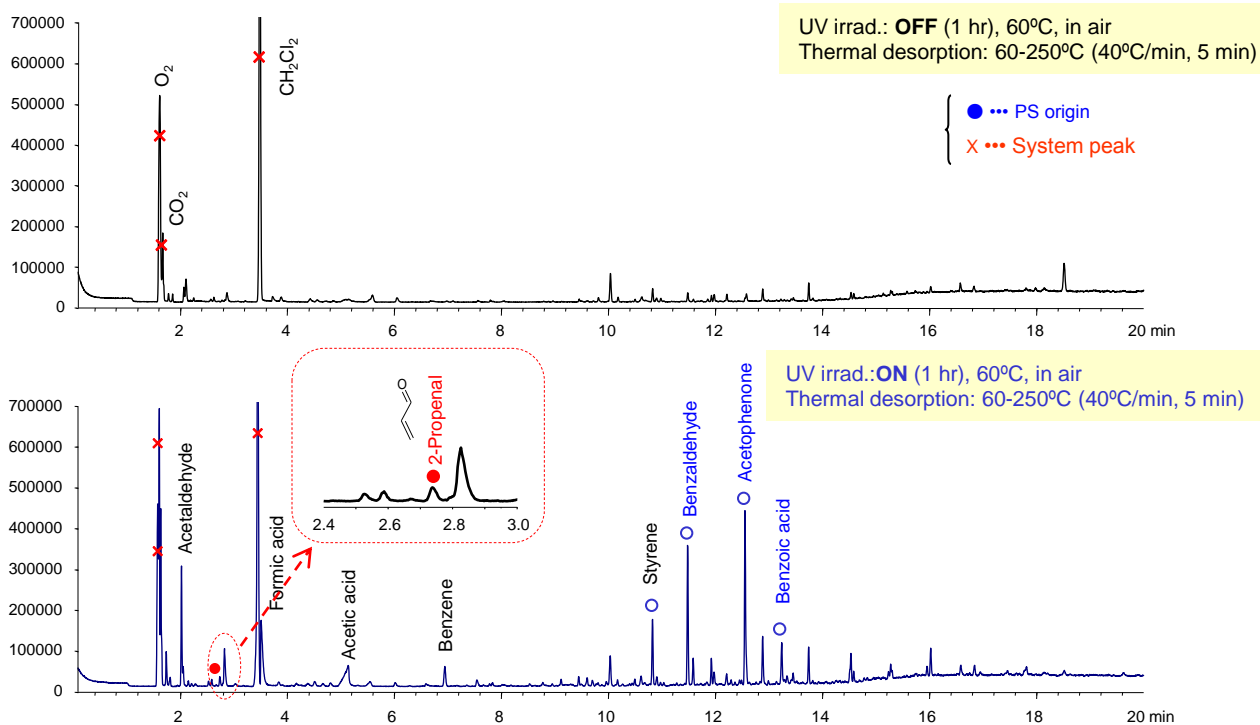


Fig 1. Chromatograms of the volatile degradation products formed when HIPS is irradiated and not irradiated.

<UV irradiation> Micro UV irradiator : UV-1047Xe, irradiation: 1 hr, furnace temp.: 60°C, atmosphere gas: 10 mL/min Air, split ratio: 1/10
 <GC/MS> Separation column: Ultra ALLOY+1 (polydimethylsiloxane, L=30 m, i.d.=0.25 mm, df=0.5 µm), GC oven temp.: 40°C(5 min)-240°C(20°C/min), GC injection temp.: 250°C, carrier gas: 50 ml/min He, split ratio: 1/50

Keyword : HIPS, Micro UV irradiator, Weather meter, Photo/thermal/oxidative-degradation, Volatile degradation product, Thermal desorption

Applications : Weathering test

Related technical notes : PYA5-004E

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