Evaluation of deterioration degree of exterior wall coatings using Micro-UV Irradiator - Part 1 Acrylic coatings with and without UV absorber and HALS

[Background] Acrylic coatings are widely used on the exterior walls of houses because of their excellent color development and long-term stability. Exposure to sunlight can cause photodegradation of the acrylic coatings; consequently, UV light absorbers and hindered amine light stabilizers (HALS) are routinely added as additives to improve the durability of the coatings. In this report, the Micro-UV Irradiator was used to irradiate two acrylic samples, one with and the other without UV absorber and HALS. The degree of deterioration of each sample was examined by evolved gas analysis (EGA-MS).

[Experimental] The samples were acrylic coatings. Sample A contained UV absorber (Tinuvin 400) and HALS (Tinuvin 292) while sample B contained no additives. After placing a sample in a sample cup (side-hole Eco-Cup UV), the sample cup was attached onto the end of the optical fiber then introduced to the furnace of the Multi-Shot Pyrolyzer (EGA/PY-3030D) set at 60 ºC. UV irradiation was performed for 1 to 20 hours in air using a Micro-UV irradiator (UV-1047Xe) with a mercury xenon lamp as a light source. EGA-MS analysis of the sample was performed before and after irradiation under He carrier gas.

[Results] The EGA thermograms of Samples A and B before, during and after UV irradiation are shown in Fig. 1. In sample A, the peak apex temperature and full-width at half-maximum (FWHM) did not change significantly before, during and after UV irradiation. This can be attributed to the effectiveness of the UV light absorber and HALS to keep the photostability over a 10-hour irradiation. The results for Sample B are much different. The peak apex temperature shifted -8 ºC after 10 hours of UV irradiation. Also, the FWHM approximately doubled (31 to 70 ºC) as the irradiation time increases. Fig. 2 shows that the both samples do not show remarkable changes in FWHM after 10 hours and the total change is less for Sample A, *i.e.* more durable, than Sample B.

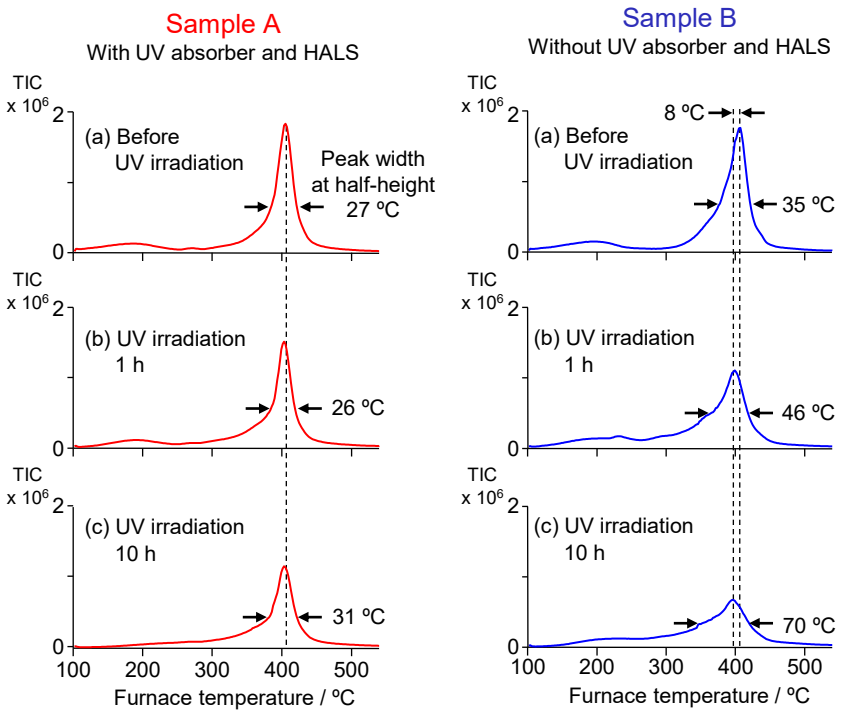

Fig. 1 EGA thermograms of samples A and B before and after UV irradiation

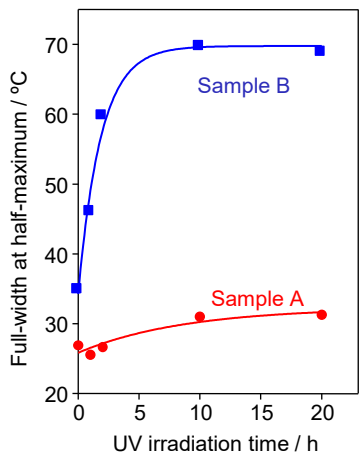

Fig.2 Plots of full-width at half-maximum against UV irradiation time

Furnace temp.: 100 – 700 ºC (20 ºC/min), EGA tube: UADTM-2.5N (*L*=2.5 m, i.d.=0.15 mm),
Column flow rate: 1 mL/min (He), Split ratio: 1/50, GC oven temp.: 300 ºC, Sample amount: 0.15 mg

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Keywords : Exterior coating, Acrylic resin, UV absorber, HALS, Photo/thermal/oxidative degradation, Micro-UV Irradiator

Product used : Multi-Shot Pyrolyzer, Micro-UV Irradiator, UADTM-2.5N, Vent-free GC/MS adapter, Side-hole Eco-Cup UV

Applications : Weathering test

Related technical notes : PYA5-005E, PYA5-006E, PYA5-009E, PYA5-011E

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