Outdoor exposure tests of 6,6-nylon cable ties
– usefulness of evolved gas analysis (EGA)-MS –

[Background] The mechanical strength of plastic cable ties is reduced when irradiated by UV light. The degradation is monitored using long-term weathering tests. This note illustrates how evolved gas analysis (EGA)-MS can be used to evaluate the degradation of 6,6-nylon cable ties caused by a prolonged exposure to indoor and outdoor environments.

[Experimental] A Multi-Shot Pyrolyzer (EGA/PY-3030D) directly interfaced to the split injector of the GC was used for the EGA-MS analysis. The surface of each sample was scraped off using a cutter knife and the powder was placed in a sample cup. It was then heated in the pyrolyzer furnace in a programmed heating mode to obtain an EGA thermogram. Three types of cable ties with different weather and heat resistances were analyzed. Each of the sample types were exposed to either indoor (stored in a tightly closed container) or outdoor environments for two years and the degree of degradation was evaluated. Exterior appearance and 20 times magnified microscopic views of each sample are shown in Fig. 1.

[Results] The EGA thermograms are shown in Fig. 2. The apex temperatures for indoor and outdoor exposures and the differences between them are noted on the thermograms. In every case, the differences in the apex temperature between indoor and outdoor exposures are more than 10ºC. The smallest difference in apex temperature (13ºC) was observed in sample No.3 which is both weather and heat resistant. This series of analysis clearly demonstrates that EGA-MS can be used to quickly, and easily identify changes caused by outdoor exposure (*i.e.,* UV exposure) of plastic cable ties.

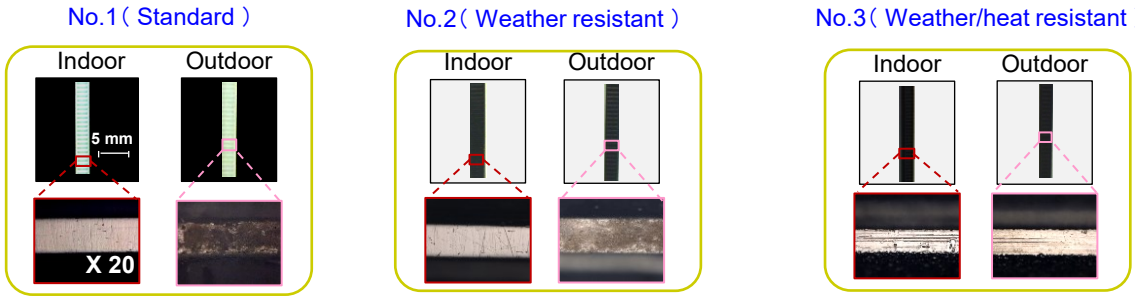

Fig.1 Color changes of cable ties after indoor/outdoor exposures (top) and 20 times magnified views of locking teeth (bottom)

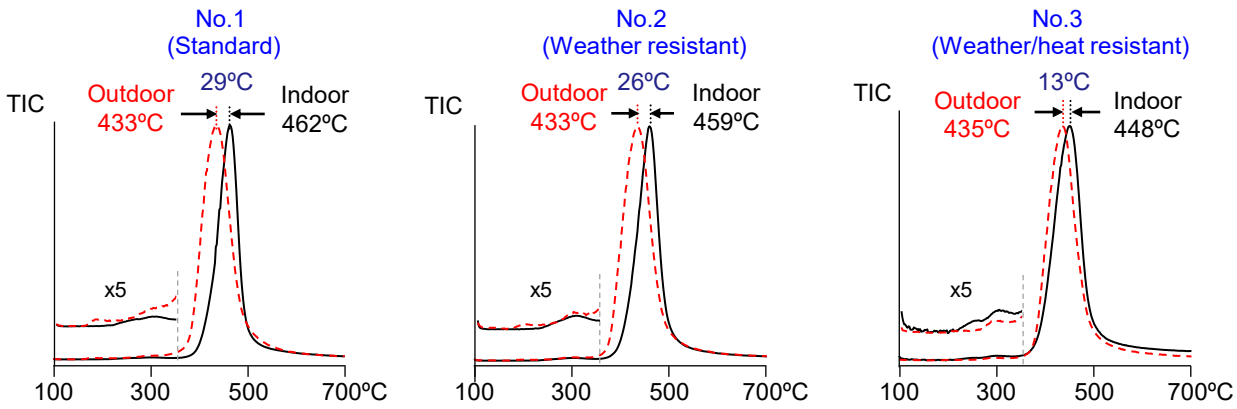

Fig.2 EGA thermograms of samples with varied degrees of weatherability

PY furnace temp.: 100 – 700ºC (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.: 300ºC, Sample wt.: ca. 0.2 mg

Keywords : Cable ties, 6,6-nylon, Exposure test, Evolved gas analysis, Degradation, Weatherability

Products used : Multi-Shot Pyrolyzer, Auto-Shot Sampler, Vent-free GC/MS adapter, UA-DTM, Eco-Cup LF

Applications : General polymer analysis, Degradation test

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