Defect analysis of air pump made of POM
Part 2 Pyrolysis (Py)-GC/MS

[**Background**] In the previous note (PYA3-041E), the comparison between a good polyoxymethylene (POM) air pump part and a defective one which failed in a short period of time was conducted using evolved gas analysis (EGA)-MS. In this note, more detailed investigation was done using pyrolysis (Py)-GC/MS.

[**Experimental**] The good and defective POM parts removed from the air pump were cut into small pieces less than 1 mm in diameter with a cutter knife. A Py-GC/MS system with a Multi-Shot Pyrolyzer directly interfaced to the GC injector was used. Samples were weighed into Eco-Cups and introduced into the pyrolyzer furnace preheated at 500 ºC for Py-GC/MS measurements.

[**Results**] Pyrograms of good and defective parts samples are shown in Fig. 1. The peak of formaldehyde (HCHO), a POM pyrolyzate, is strongly observed in both good and defective parts. In the pyrogram of the good part sample, peaks of compounds containing oxyethylene units (-O-C_2H_4-) (Fig. 2) are detected at retention times 3 and 5 min. Based on this, the resin of the good part should be a copolymer of POM and ethylene oxide. On the other hand, only formaldehyde was detected in the defective sample, indicating that POM homopolymer is the main constituent. Based on these results, the failure of the POM resin part may be due to the use of homopolymer with a poor heat resistance as a raw material.

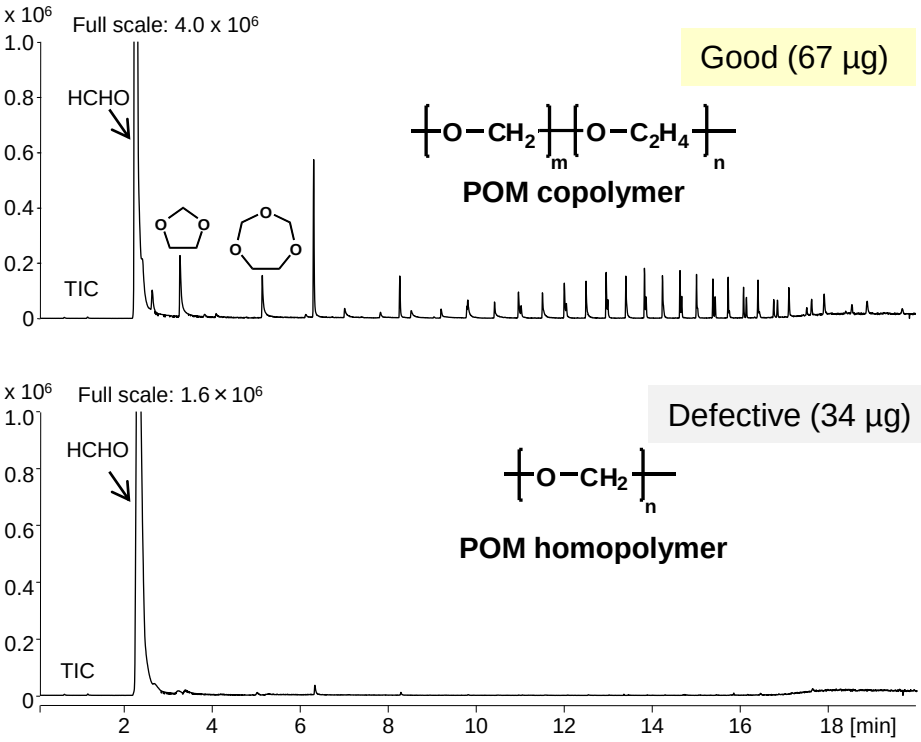

Fig. 1 Pyrograms of good and defective POM parts measured at 500 ºC

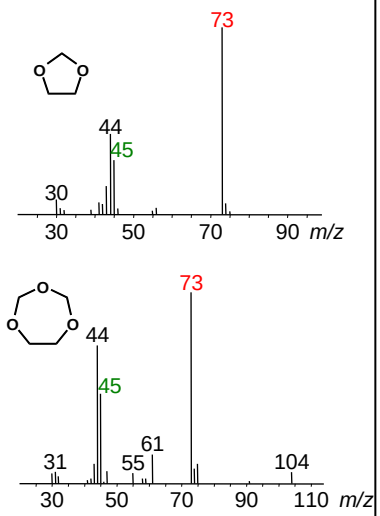

Fig. 2 Mass spectra of compounds having oxyethylene unit (-O-C_2H_4-)

Furnace temp.: 500 ºC, GC oven temp.: 40 (2 min) - 320 ºC (20 ºC/min, 4 min hold),
Separation column: UA⁺-5 (5 % diphenyl 95 % dimethylpolysiloxane), *L*=30 m, i.d.=0.25 mm, df=0.25 µm,
Column flow rate: 1 mL/min He, Split ratio: 1/50, Sample amount 67 µg and 34 µg for good and defective samples, respectively.

Keywords : Polyacetal, polyoxymethylene, POM, Copolymer

Products used : Multi-Shot Pyrolyzer, Auto-Shot Sampler, UA⁺-5, Eco-Cup LF, Quartz wool, F-Search, Vent-free GC/MS adapter

Applications : General polymer analysis, Quality assurance, Material analysis, Defect analysis

Related technical notes : PYA3-041E (Part 1), PYA2-013E

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