Effects of measurement conditions on peak temperature in Evolved Gas Analysis (EGA)-MS Part 2: Furnace temperature ramp rate

[**Background**] In the previous report (PYA3-045E), the relationship between the amount of polystyrene (PS) sample and the peak temperature observed in the EGA curve was examined. In this report, EGA-MS measurements were performed on PS samples by varying the ramp rate of the furnace, and the relationship between the ramp rate and the peak temperature was examined.

[**Experimental**] A GC/MS system equipped with a Multi-Shot Pyrolyzer directly interfaced to the GC injector was used for measurements. A deactivated metal tube (UADTM-2.5N) and a Vent-free GC/MS adapter were used to connect the GC injector and the MS detector. 0.2 mg each of powder PS sample was weighed into an Eco-Cup and introduced into the furnace. The furnace temperature was ramped from 100 ºC to 700 ºC by varying the furnace temperature ramp rate in the range of 1 - 40 ºC/min, and EGA-MS measurements were performed.

[**Results**] The EGA curves of PS measured at various furnace temperature ramp rates (1 - 40 ºC/min) are shown in Fig. 1, while the plots of peak temperature against furnace temperature ramp rate are shown in Fig. 2. As the temperature ramp rate increases, the peak temperature shifts to higher temperatures. This shift can be attributed to the reaction kinetics in the pyrolysis of the polymer and the heat transfer to the interior of the sample. Therefore, to obtain data on the peak temperature in EGA-MS and investigate thermal desorption/pyrolysis behavior, it is crucial to maintain consistent ramp rates across all samples.

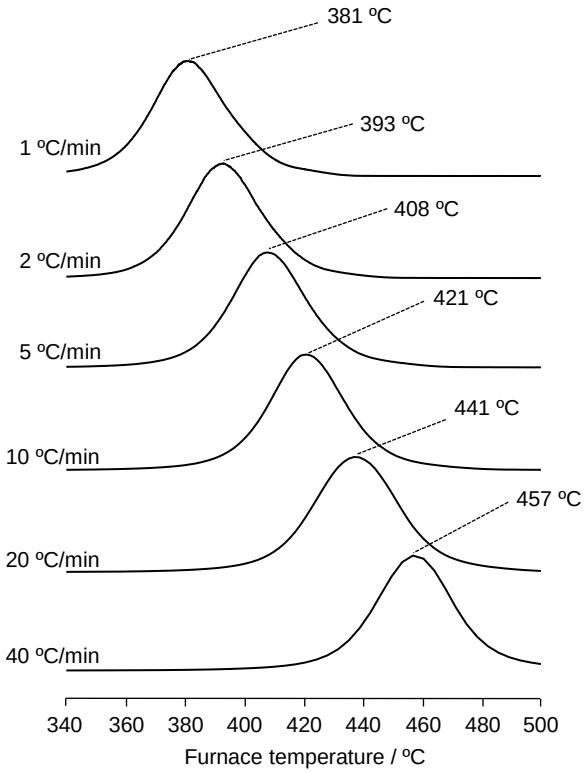

Fig. 1 EGA curves of PS obtained at varied furnace temperature ramp rates.

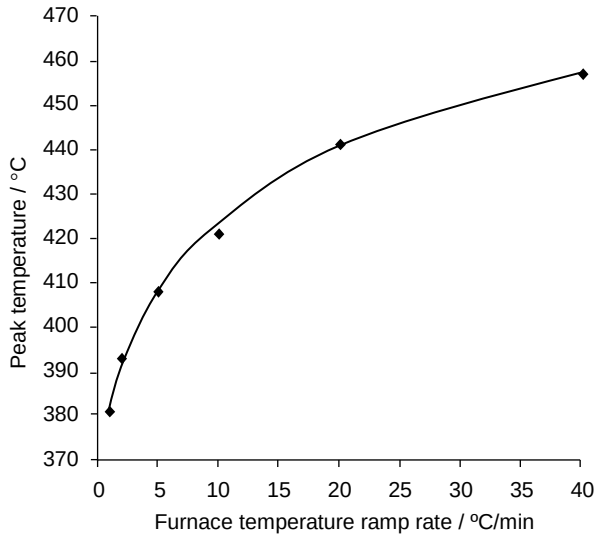

Fig. 2 Relationship between furnace temperature ramp rate and peak temperature in EGA curves of PS.

Furnace temp.: 100 - 700 ºC (ramp rate: 1 ºC/min - 40 ºC/min), EGA tube: UADTM-2.5N (*L*=2.5 m, i.d.=0.15 mm), Flow rate: 1 mL/min (He), Split ratio: 1/50, GC oven temp.: 300 ºC, MS scan rage: *m/z* 29 - 550, MS scan rate: approx., 0.2 scan/s, Sample amount: 0.2 mg

Reference: A. Shiono *et al.*, *Polym. Test.*, 42 (2015) 54-61.

Keywords : EGA-MS, Thermal analysis, Thermal decomposition behavior, Polystyrene

Products used : Multi-Shot Pyrolyzer, Auto-Shot Sampler, UADTM-2.5N, Eco-Cup LF, Vent-free GC/MS adapter

Applications : General polymer analysis, Material analysis

Related technical notes : PYA3-046E (Part 1)

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Frontier Laboratories Ltd.
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