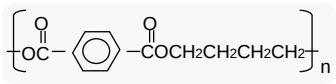
Analysis of Flame Retardant Polymers

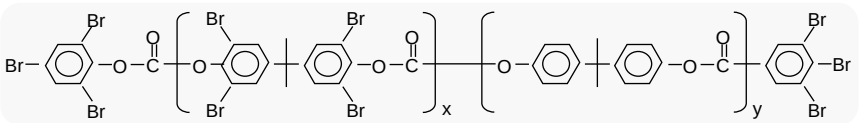
Part 1 : Analysis of Evolved Gases using Atomic Emission Detector (AED)

Because plastics used in enclosures of home appliances and office equipment require flame retardant properties, a variety of flame retardants have been studied. An example described here is elucidation of flame retardant mechanism of brominated polycarbonate (15%) and antimonious oxide (5%) (see Fig. 1) added, as flame retardants, to polybutylene terephthalate (PBT) using Double-Shot Pyrolyzer. Fig. 2 shows evolved gas curves of Sb, Br, and C contained in the flame retardant PBT. By the catalytic action of Sb_2O_3, brominated compounds are eluted at lower temperatures than flammable gases such as butadiene and butylene terephthalate produced during the thermal decomposition of PBT, thus it is considered that the flame retardants inhibits the ignition of PBT at the early stage of decomposition. As shown here, observing the elution of targeted elements in the evolved gases by AED provides an insight into the effect of flame retardants.

• Base polymer : Polybutylene terephthalate (PBT), 80wt%



• Flame retardants :
1) Brominated polycarbonate, 15wt%
2) Antimonious oxide (Sb_2O_3), 5wt%



Copolymer of tetra-bromo-bis-phenol A and bis-phenol A (2/1) Average degree of polymerization = 3

Fig. 1 Base Polymer and Structure of Flame Retardant

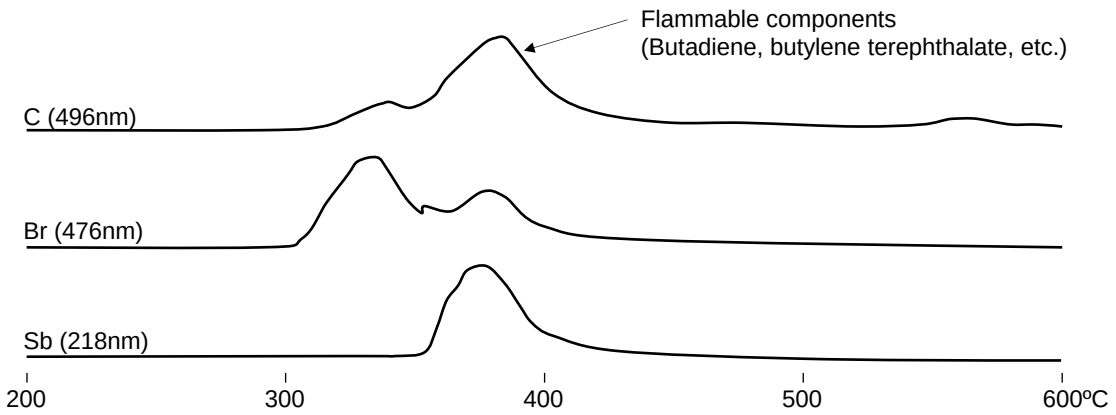


Fig. 2 Thermal Decomposition of Flame Retardant PBT Observed Using EGA
(Detector : AED(Atomic Emission Detector), Atmosphere gas : He)

Excerpt from Sato, H., Kondo, K., Tsuge, S., Ohtani, H. & Sato, N., *Polymer Degradation and Stability*, 1998, 62, 41-48

Keywords : Evolved Gas Analysis, Atomic Emission Detector, Flame Retardant, PBT, Brominated PC, Antimonious Oxide

Products used : Multi-functional pyrolyzer, Deactivated metal capillary tube

Applications : General Polymer Analysis

Related technical notes :

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