

# Analysis of tire rubbers

## Part 2 Identification of rubber constituents by Pyrolysis-GC/MS

**[Background]** In the previous report ([PYA1-114E](#)), rubber samples taken from different parts of an automobile tire were analyzed by thermal desorption (TD)-GC/MS. Additives were present in all samples and the concentration of an antiaging agent was found to depend on the tire parts. In this report, the rubber constituents in each tire part were identified by pyrolysis (Py)-GC/MS.

**[Experimental]** Rubber samples were collected from (a) tread, (b) shoulder, (c) sidewall, and (d) bead of an automobile tire. All samples were analyzed by the double-shot mode. For the measurements, a GC/MS system in which a Multi-Shot Pyrolyzer (EGA/PY-3030D) was directly interfaced to the GC injector was used. First, the sample was heated from 100 to 320 °C (20 °C/min, 1 min hold) in a temperature-programmed mode. The thermally desorbed additives were separated and detected by GC/MS. Next, the furnace temperature was set to 600 °C and the sample was dropped into the furnace for flash pyrolysis, followed by the GC/MS analysis of pyrolyzates.

**[Results]** The pyrograms of the tire rubbers of different parts are shown in Fig. 1. In Figs. 1 (a) and (b), strong peaks of styrene and 1,3-butadiene are recognized, which are originated from styrene-butadiene-rubber (SBR). Peaks of isoprene and dipentene can be originated from natural rubber (NR), and these peaks are intensified in Figs. 1 (c) and (d), suggesting that NR is the major constituent in sidewall and bead. In addition, peaks of 1,3-butadiene and 4-vinylbenzene can be related to butadiene rubber (BR). From these results, it is clear that different types of rubbers are used in a single tire.

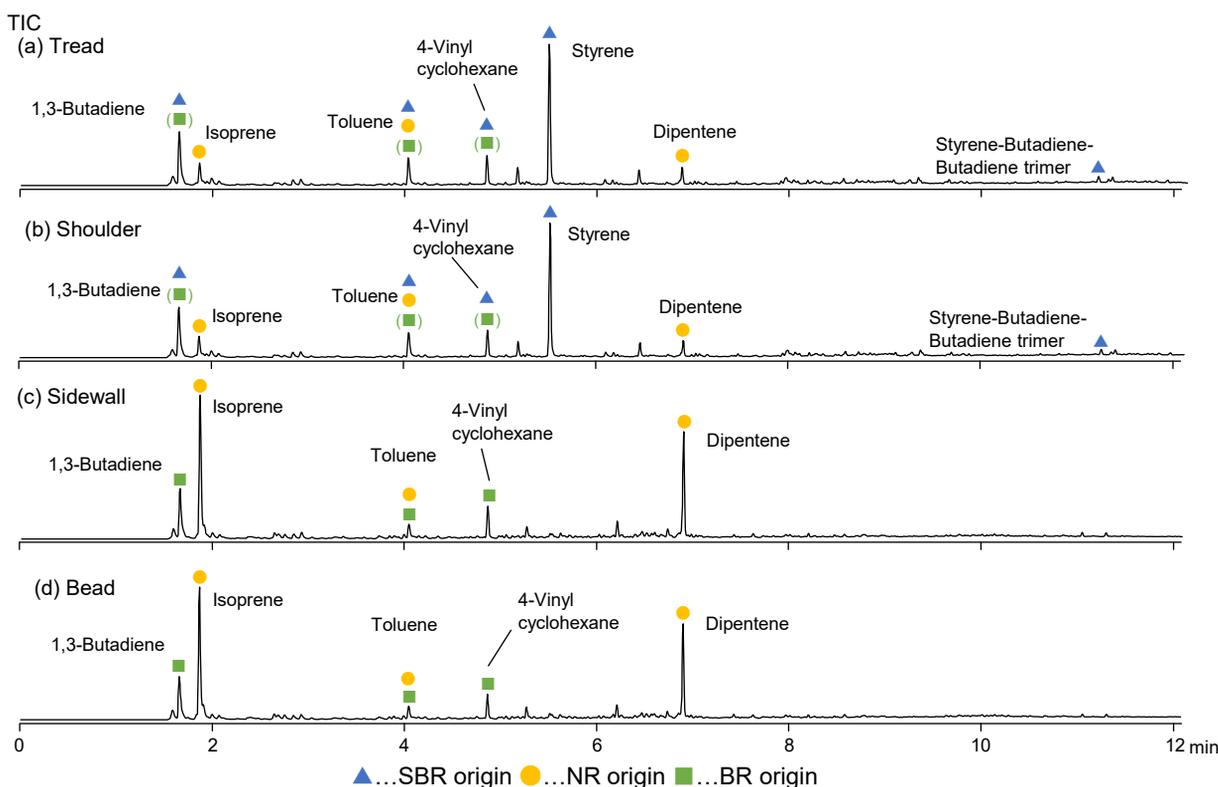


Fig. 1 Pyrograms of rubber samples taken from different tire parts

Py furnace temp.: 600 °C, Sample amount: ca. 0.2 mg, MS scan rate:  $m/z$  29 - 600  
 Split ratio: 1/100, GC oven temp.: 40 °C (2 min hold) - 320 °C (20 °C/min, 14 min hold), Flow rate: 1 mL/min  
 Separation column: UA<sup>+</sup>-5 (5 % diphenyl 95 % dimethylpolysiloxane), L=30 m, i.d.=0.25 mm, df=0.25 μm

**Keywords :** Rubber, Pyrolysis-GC/MS

**Products used :** Multi-functional pyrolyzer, UA<sup>+</sup>-5, Vent-free GC/MS adapter

**Applications :** General polymer analysis, Rubber industry, Forensic, Quality assurance

**Related technical notes :** [PYA1-110E](#), [PYA1-077E](#), [PYA-0114E](#)

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