2.16 Analysis of tire rubber (1) - GCMS

•Explanation

Large quantities of carbon black are added to the rubber compounds of tire rubbers. As they do not dissolve in solvents, thermal decomposition gas chromatographs are use to obtain structural information. Figs. 2.16.1 and 2.16.2 are the results of analysis of gas generated at the pyrolysis temperatures of 450°C and 700°C. At 450°C only the rubber compounds are broken down, resulting in a relatively simple chromatogram. At 700°C carbon black is broken down as well, resulting in a complicated chromatogram.

•Analytical Conditions

Model	:	Shimadzu GCMS-QP5000
Column	:	CBJ1 0.25mm × 30m i.d. df=0.25μm
Column Temp.	:	50°C (1min)-7°C/min-320°C
Carrier Gas	:	He 100kPa
PyrolysisTemp.	:	450°C,700°C
InterfaceTemp.	:	250°C
Split	:	30:1

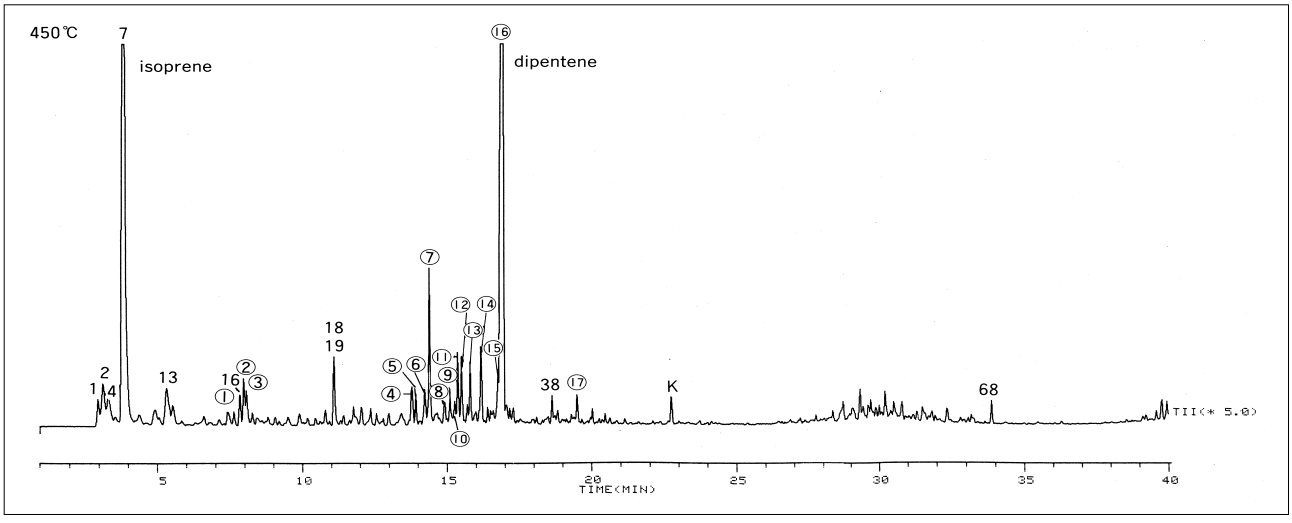

Fig. 2.16.1 Total ion chromatogram of the decomposed products generated at 450°C

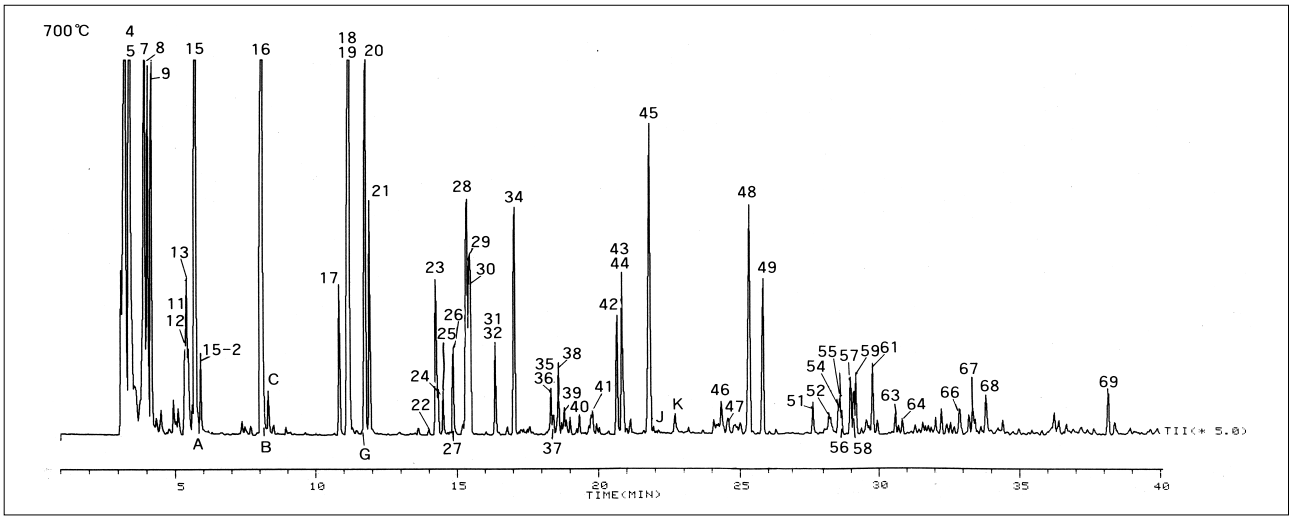

Fig. 2.16.2 Total ion chromatogram of the decomposed products generated at 700°C

2.16 Analysis of tire rubber (2) - GCMS

Fig. 2.16.3 is the mass chromatogram at 450°C. Isoprene (C_6H_8 peak 7) and diterpene ($C_{19}H_{16}$ peaks (5)-(16)), which are monomers of natural rubber, have been detected.

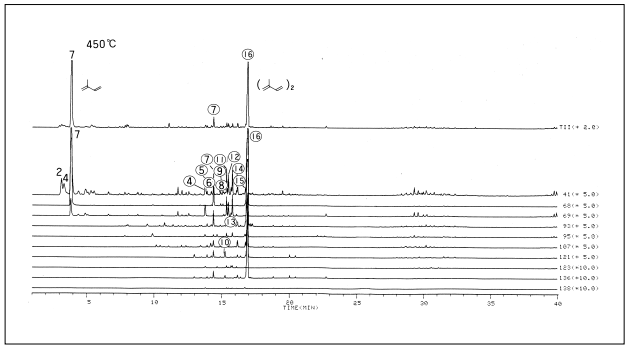

Fig. 2.16.3 Mass chromatogram at 450°C

At 700°C the decomposed products generated consist mainly of aromatic hydrocarbons, and there are less isoprene compounds. Of these many peaks, Figs. 2.16.4 and 2.16.5 examines the S-compounds.
Figs. 2.16.6 and 2.16.7 show the results of data searches on the B and J mass spectra in the chromatograms. They have been respectively identified as 2-methylthiophene and benzo thiophene.

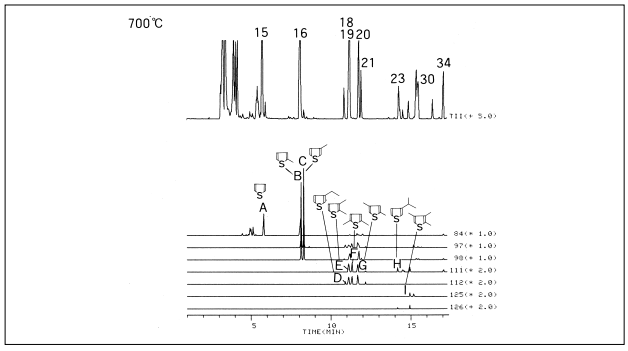

Fig. 2.16.4 Mass chromatogram-1 examining the S-compounds

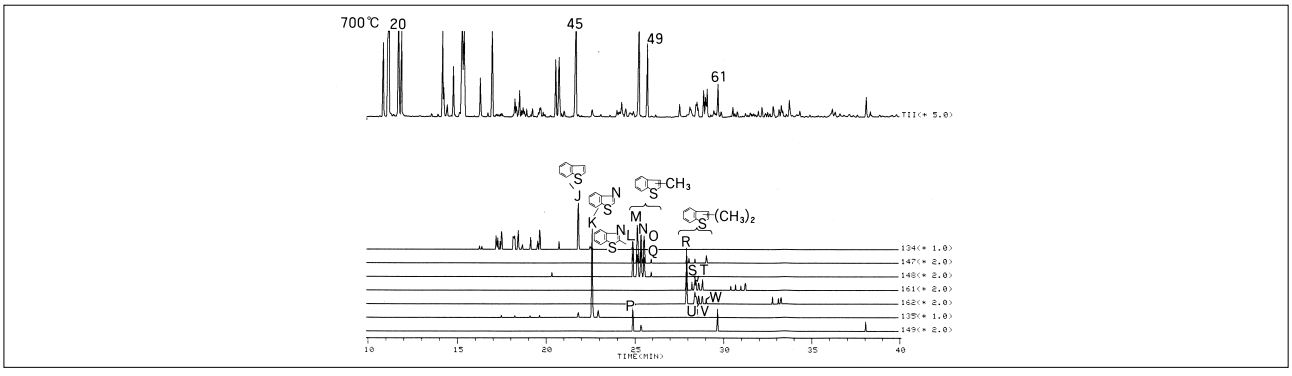

Fig. 2.16.5 Mass chromatogram-2 examining the S-compounds

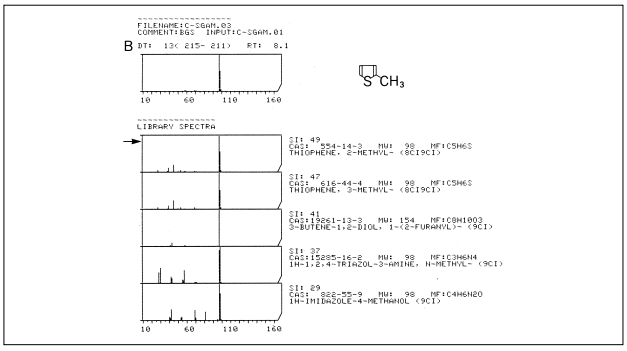

Fig. 2.16.6 Results of data search on peak 'B'

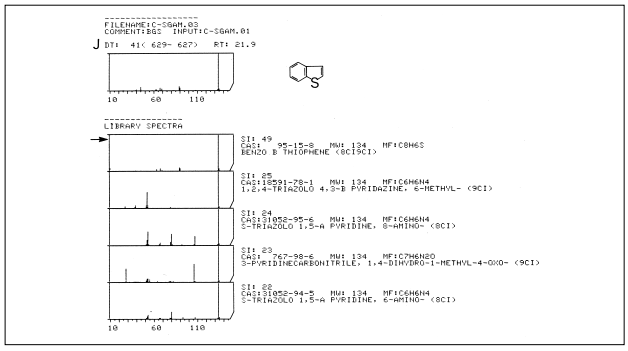

Fig. 2.16.7 Results of data search on peak 'J'