Examination of the Thermal Degradation of Linear and Crosslinked Polystyrene by Means of Mass Spectrometry

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Thermal degradation (pyrolysis) of styrene-divinylbenzene copolymers in evacuated glass ampoules was used to detect crosslinking. The products were liquid and gaseous (fraction V_{gas}). The latter were analyzed with a mass spectrometer; methane, ethene, propane, propene, benzene, toluene, ethylbenzene, styrene, cumene and traces of CO, CO_{2}, acetylene and ethane were found. The degradation products were characteristic of the copolymer composition. In order to detect the crosslinking (i.e. the percentage of divinylbenzene), it is sufficient to measure the absolute peak heights in the mass spectrum and to detect the coeff. \( k \) given by

\[
  k = \frac{\text{peak height at } (m/e 15 + m/e 16 + m/e 27 + m/e 28 + m/e 44)}{\text{peak height at } (m/e 51 + m/e 78 + m/e 91 + m/e 106)}
\]

This coeff. shows the relation between light and heavy components in the fraction V_{gas}. The corresponding percentage of divinylbenzene can be then found from the obtained calibration chart. The method is sensitive enough for copolymers with 30% or more divinylbenzene.

The quantity of liquid residue increased with the percentage of divinylbenzene. IR and NMR investigations show variations in the composition of liquid residue of copolymers with different percentage of divinylbenzene.

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Crosslinking of polystyrene, detn. with a mass spectrometer
Mass spectrometry, of degradation products of linear and crosslinked polystyrene
Thermal degradation, of linear and crosslinked polystyrene