

## [IV~18]

### Polymer Surface Characterization Using Time-of-Flight Secondary Ion Mass Spectrometry

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High resolution Time-of-Flight Secondary Ion Mass Spectrometry (TOF-SIMS) has become a powerful technique for structural characterization and surface analysis of polymers. Intractable polymer surfaces which are not easy to analyze using conventional mass spectrometry and other instruments were studied by TOF-SIMS. This technique provides the molecular weight distribution, data on the sequence of repeat units, polymer additives, and impurities and structural information. TOF-SIMS offers good sensitivity and structural specificity for high mass ions so that intact oligomers and large polymer fragments are observed.

The detailed study of the high-mass, high-resolution mass spectra of polyesters and polystyrenes was reported. TOF-SIMS spectra of a series of polyesters with different diols and diacids were obtained in the mass range  $m/z = 0-3500$ . TOF-SIMS positive and negative ion spectra of poly(ethylene succinate), poly(trimethylene succinate), poly(trimethylene glutarate), poly(ethylene adipate), poly(trimethylene adipate), poly(butylene adipate), and poly(neopentyl glycol sebacate) were obtained.

Transesterification of polyesters by trifluoroacetic acid (TFA) and chlorodifluoroacetic acid (CFA) was studied using the TOF-SIMS. TOF-SIMS spectra were used to obtain information about the progress of the transesterification reaction. Transesterification was also applied to branched poly(1,3-butylene adipate). Transesterification products such as 2-, 3-, and 4-tagged fragments were identified in the TOF-SIMS spectra to give information about polymer branching.

Positive ion mass spectra of various polystyrenes were also obtained using TOF-SIMS. TOF-SIMS spectra of polystyrene, poly( $\alpha$ -methyl styrene), poly(4-methyl styrene), poly(4-tert-butyl styrene), poly(4-chloro styrene), poly(vinyl benzyl chloride), poly(4-vinyl biphenyl), and poly(vinyl naphthalene) were observed. The mass of the polystyrene repeat unit is determined from spacings between consecutive oligomers and/or fragment peaks.