CHEMICALLY SENSITIVE SEC DETECTION BASED ON ONLINE COUPLED FTIR SPECTROSCOPY

Timo F. Beskers[a,b], Jennifer Kübel[b], Thorsten Hofe[c], Harald Pasch[a] and Manfred Wilhelm[b]

[a]University of Stellenbosch, Department of Chemistry and Polymer Science, Stellenbosch, South Africa.
[b]Karlsruhe Institute of Technology (KIT), Institute for Chemical Technology and Polymer Chemistry, Karlsruhe, Germany Email: manfred.wilhelm@kit.edu.
[c]PSS Polymer Standards Service GmbH, Mainz, Germany.

ABSTRACT

Polymers have three important molecular characteristics, which influence their material properties: the molecular weight distribution (MWD), the chemical composition and the topology. The MWD is usually determined using size exclusion chromatography (SEC). Information on chemical composition and topology is normally gained separately using spectroscopic methods, because the SEC detectors commonly in use, such as refractive index detectors, light scattering or viscometers, do not provide any information about the chemistry or topology. Especially when analyzing modern, complex materials like copolymers, blends or unknown samples, the correlated measurement of size and chemical properties is of special interest, not only to better understand the influence of molecular properties on material characteristics, but also for industrial quality control, material design and product development.

Coupling spectroscopy with SEC seems a promising approach to gain this correlated information. An inherent problem to this pairing is the low concentration necessary for SEC, which normally results in high solvent signals. Several approaches, mostly with highly complex or expensive equipment have been reported in literature and reviewed in [1].

Fourier transform infrared spectroscopy (FTIR) is universally applicable to all polymers and is comparably cheap. Here we present an online coupled method consisting of an optimized, highly sensitive FTIR spectrometer and a SEC with specialized flow cells. The method is based on a newly developed mathematical solvent suppression routine.[2] The FTIR spectrometer here works as a chemically sensitive SEC detector that can identify and quantify different analytes and is also able to measure samples that other detectors fail to measure, such as, for example, isorefractive samples.

The general setup, the newly constructed flow cells, the mathematical solvent suppression, the influence of column dimensions as well as several application examples will be presented.

References:

[1]Pasch, H. *Polym. Chem.*, **2013**, *4*, 2628.
[2]Beskers, T.F.; Hofe, T.; Wilhelm, M. *Polym. Chem.*, **2015**, 6, 128.