Building a bigger, better toolkit for polymer characterization

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Abstract: Polymer and catalyst systems continue to become more complicated as their potential applications and performance expectations become more demanding. In order to support the creation, development and deployment of these materials, today's industrial analytical chemists must look beyond common, workhorse techniques and establish new and more specialized characterization and data analysis approaches. One example is a cutting-edge new technique that couples the nano-scale spatial resolution of atomic force microscopy (AFM) with the molecular characterization capability of infrared (IR) spectroscopy to characterize inclusions and domains in polymer blends smaller than 20 nm. The onset melt temperature of those nano-scale features then can be probed by utilizing switching to heated AFM tips. The development of AFM-IR and its application to common polymers, such as polycarbonate (PC) and polycarbonate/ acrylonitrile-butadiene-styrene (PC/ABS) blends, will be presented. In another case, variable temperature IR spectroscopy, combined with chemometric data analysis, is a powerful tool to investigate thermally-driven transformations, like thermal degradation and thermoset reactions. Since new materials often require new synthesis reactions to be developed, in-situ reaction monitoring tools, such as mid- and near-infrared (IR) and ultraviolet-visible (UV-VIS) spectroscopies, are essential for chemists to be able to track changes in key functional groups continuously and respond immediately. Chemometric data analysis routines, such as multivariate curve resolution (MCR), can be applied subsequently to extract more information about the reaction. In other cases, characterizing the structure of a copolymer reveals details about the process used to create it. The application of two-dimensional (2D) liquid chromatography (gradient polymer elution chromatography x gel permeation chromatography, GPEC x GPC) coupled with UV and IR detection to bulk acrylonitrile butadiene styrene (BABS) copolymers will be presented.

Biography: Dr. Nancy L. Jestel is a chief scientist with SABIC in Selkirk, NY, USA. Her areas of expertise include vibrational spectroscopy, statistics and chemometrics, and process analytical. Dr. Jestel has Bachelor of Business Administration and Bachelor of Science in Chemistry degrees from the University of Massachusetts at Amherst and a PhD from the University of Michigan jointly in Chemistry and Biological Materials Science. After graduate school, she joined General Electric's Plastics business in their Technical Leadership Program, working at several sites. Dr. Jestel is a certified DFSS Black Belt and served as SABIC's Global Spectroscopy Functional Group Leader. She was recognized with both GE's Women in Technology and Richard Chang Analytical Awards for significant technology contributions to the business. Her work focuses on innovative analytical method development to support the business' new chemistry and process initiatives.