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A Bimonthly Newsl

Nano Brief

To keep pace with market needs, and to meet and greet our existing and potential customers continuously in 2025, Ebatco has and will exhibit in several regional and national conferences and exhibitions. Upcoming events include the following:

- September 28-October 1 – The Advanced Materials Show (USA), Booth #429, Greater Columbus Convention Center, Columbus, OH
- October 6-9 – The Battery Show North America, Booth #1027, Huntington Place, Detroit, MI, representing Kyowa Interface Science Co., Ltd.
- October 21-22 – MD&M Minneapolis, Booth #2528, Minneapolis Convention Center, Minneapolis, MN
- November 16-20 – ISTFA, Booth #408, Pasadena Convention Center, Pasadena, CA

If you are attending any of these events, please come and visit us to discuss how Ebatco could support you on your unmet analytical and testing needs!

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- Ebatco President, Dr. Dehua Yang, Board Trustee of ASM International, attended the ASM Board Meeting in Vancouver, Canada, May 5-8. While there, he also participated the AeroMat 2025, held in conjunction with International Thermal Spray Conference and Exposition (ITSC) 2025, International Conference on Quenching and

Distortion Engineering (QDE) 2025, and AeroTech 2025, which featured comprehensive technical programs, large exhibitions and expert speakers.

- Representing Kyowa Interface Science Co., Ltd., Dr. Dehua Yang and Dr. Lawrence Anderson exhibited at the North America Society for the Advancement of Material and Process Engineering (SAMPE) Conference and Exhibition, May 18-22 in Indianapolis, IN. Dr. Yang and Dr. Anderson appreciated the booth visitors sharing their expertise and challenges in composite materials processing and hoped that Kyowa and Ebatco would be able to support the visitors through high quality instruments of Kyowa and/or on-demand lab services of Ebatco in the near future.

- We are thrilled to announce the following promotions!

  Hayden Baker has been promoted to Senior Analysis and Applications Engineer, effective June 2. Hayden has excelled at advancing and maintaining our quality department along with excellent customer service and quality and efficiency in all of his projects.

  Dr. Lawrence Anderson has been promoted to Senior Materials Scientist, effective June 2. In his first year with Ebatco, Dr. Anderson has been trained on and has operated over 25 instruments. He has excelled in many areas such as customer interfacing, quotation generation, marketing support in many aspects, along with quality project management.

  We are confident that Hayden and Lawrence will excel in their new roles with Ebatco. Congratulations!

Case Study

Monitoring Polymer Orientation using Raman Microscopy

The orientation of polymers in a 3D arrangement plays important roles in determining not only the strength of the cured polymer but also affects a host of other physical properties like crystallization temperatures, glass transition temperatures, and wettability. Methods such as polymer extrusion are designed to assemble polymeric structures in a particular direction. Additional parameters such as the curing rate and downstream addition of additives all can critically affect the final polymer structure. As such, determining polymer orientation during product development, as a quality control check, and for failure analysis is critical.

The intensity of Raman scattering is dependent upon the angular relationship between the incident laser radiation electric field, the Raman scattering tensor (the functional group interacting with the laser radiation), and the polarization angle of the analyzer. By controlling the angle and orienting samples wisely, the analyst can obtain important information regarding the directional organization of molecules in the sample. This is well-suited for investigations into failure analysis, polymer extrusion, or confirming degrees of crystallinity or amorphousness.

To determine the relative orientation of functional groups present in a polymer, a sample of packaging tape was placed on a glass slide and imaged using a WITec 300RA Confocal Raman Microscope. The peak pattern indicates the transparent backing of the tape (not the adhesive) is made from polypropylene. The incident laser radiation was orientated parallel to the x-axis. The results of the experiment are shown in Figure 1. The polarization of the analyzer was first set to 0° (orange, Figure 1) and then increased in 30° increments to 90° (black, Figure 1).

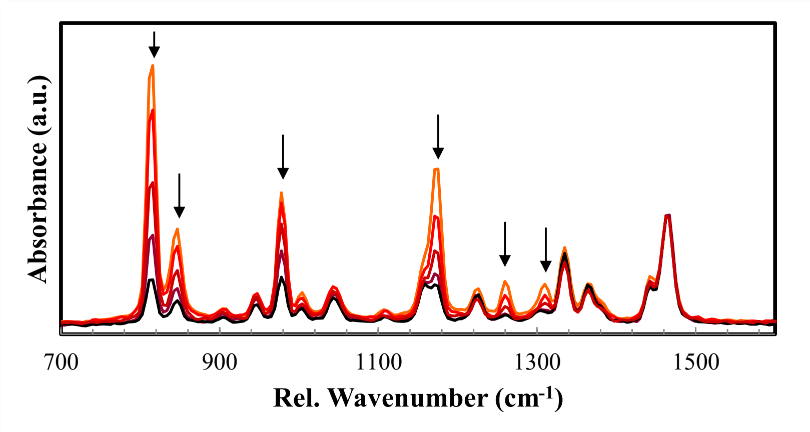
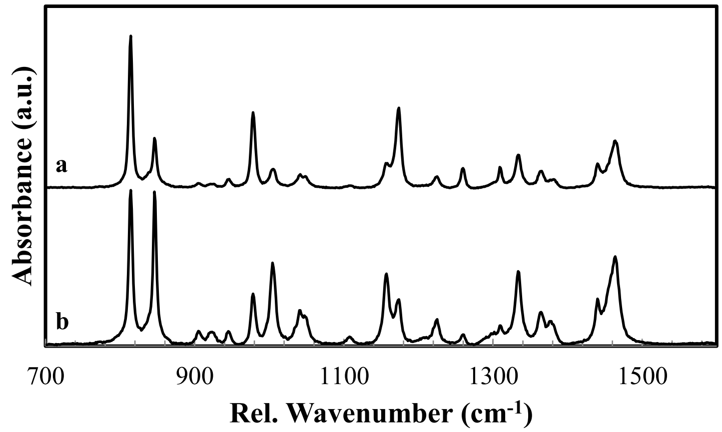


Figure 1. Polarized Raman spectra of transparent packaging tape. The angle between the incident laser light and the analyzer was set to 0° (parallel), 30°, 45°, 60°, and 90° indicated by the lines darkening from light orange to black, respectively. Arrows indicate the peak intensity shifts as the polarization analyzer was rotated.

As can be seen from Figure 1, some absorption bands are sensitive to the angle of the polarization of the analyzer (840 cm-1, 980 cm-1, 1180 cm-1), and some bands are not (1480 cm-1, 1300 cm-1). This variation is expected for highly organized, rigid polymer structures in which absorption bands associated with the backbone of the polymer (C-C stretching bands) are polarization dependent, but the bands associated with less ordered, more symmetric side chains of the polymer (CH3 stretching bands) are not polarization dependent.

The relative heights of particular peaks can indicate the orientation of the polymer. The peaks can be analyzed for liquid crystalline polymers, amorphous polymers, or cured polymers and the interpretation is relatively straightforward so long as the spectral features for the ordered and amorphous reference states are known. In this example, the packaging tape was oriented in two directions: one in which the incident laser light and analyzer polarization were both parallel to the direction of the polypropylene (Figure 2, a) and one in which the incident laser light and analyzer polarization were both oriented perpendicular to the polypropylene strands (Figure 2, b).

The results are summarized in Figure 2 and there are some immediately apparent spectral changes that occur



as a result of the high degree of orientation of the polypropylene.

The molecular orientation of polymers significantly affects the resulting properties of the final product. Disoriented polymers have been implicated in a wide variety of failure analyses across almost all industries including the medical device, pharmaceutical, and automotive industries. Polarized Raman spectroscopy is a valuable tool used to monitor the macromolecular orientation of molecules as well as the molecular orientation of functional groups to assist with product development and optimization.

Figure 2. Polypropylene polymer oriented in two directions: (a) incident laser light and analyzer polarization both parallel to the direction of the polypropylene, and (b) incident laser light and analyzer

polarization both perpendicular to the direction of the polypropylene.

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