



Application Note AN N516

Copolymer Blend Composition

Nylon 6 blends with Nylon 66 (Nylon 6/66) are useful copolymer resins suited for applications requiring excellent abrasion resistance.

Applications for these Nylon blends include grass trimmer line, cable jacketing packaging and carpet. Producers of pelletized Nylon 6/66 blends need a fast accurate way to determine the percent Nylon 6 in the Nylon 6/66 copolymer blend. Raman spectrometry offers the potential to perform this analysis directly on pellets of copolymer resin off-line in the plant Quality Lab or at-line in the operations area of the plant.

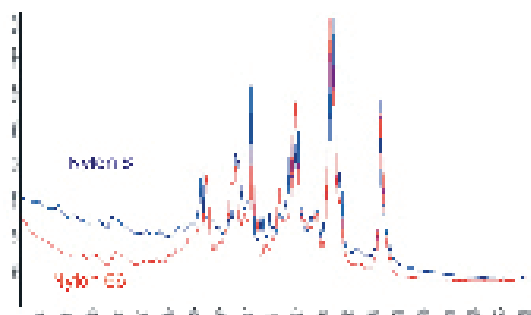
Experimental

A Bruker Optics Sentinel Raman spectrometer with a 500 mW 785 nm diode laser, 785 nm Unilab Raman probe, rotating stage and OPUS acquisition and chemometric software as well as OPUS Process software were used to obtain the spectra and build the method used to quantitatively determine the concentration of Nylon 6 in pellets of the copolymer Nylon 6/66 blend.

Results and Discussion

Results and Discussion: Raman spectra of pellets of Nylon 6/66 copolymer blend standards containing 10.5 to 25.0 percent Nylon 6 were obtained by use of a rotating stage

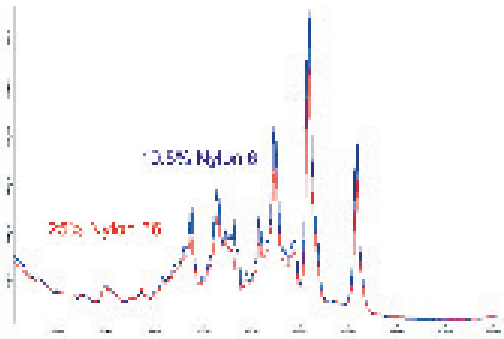
Figure 1



Nylon 6 and 66 Pellets

with the non-contact Unilab Raman probe. Figure 1 shows the spectra of Nylon 6 and Nylon 66. Figure 2 shows the spectra of 10.5% and 25% copolymer blend pellets. Figure 3 shows the results of the chemometric model utilizing all the features of the sample spectrum in the range of 553 – 1804 Rcm^{-1} . The correlation coefficient of the vector normalized mean centered chemometric model was 99.91 with a root mean square error of cross validation (RMSECV) of 0.162. Figure 5 illustrates how OPUS Process software can be used to track changes in the concentration of Nylon 6/66 blends.

Figure 2

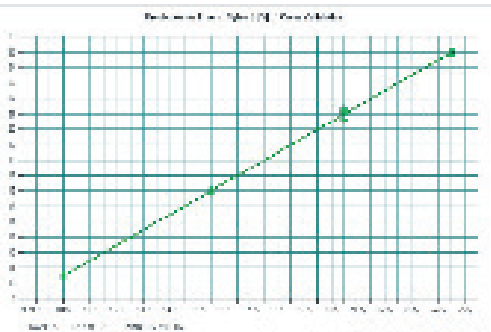


Nylon 6/66 Blends: 10.5% and 25% Nylon 6

Conclusion

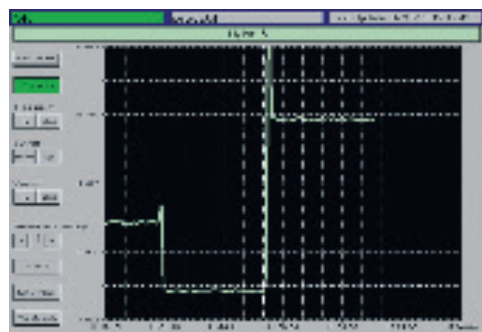
These results show that Raman can be used for determination of Nylon 6 in Nylon 6/66 copolymer blends. The Sentinel Raman unit with a rotating stage can be used in the Quality Lab or by means of fiber optics, the Sentinel can be used at-line by the plant operator to provide plant operators and engineers more real-time information for both product quality and operational control.

Figure 3



Prediction vs True Graph

Figure 4



Process Monitor Trend Chart

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