

Synthetic Rubbers: Polychloroprene

Since the advent of the Second World War, synthetic rubber has played an ever-larger role in the polymer realm. With supplies of natural rubber cut off in Southeast Asia, the United States embarked upon an ambitious program to synthesize and characterize synthetic rubber samples to replace the natural rubber it could no longer obtain.

The 1940s became a kind of "Golden Age" of polymer investigation. Bruno Zimm, Walter Stockmayer, Peter Debye and others played large roles in creating characterization apparatus as well as novel polymers to replace those that the Axis powers had cut off. Because these rubber products depended so heavily on their molecular weight distributions to give them the rheological properties that were desired, light scattering instruments were invented to determine the molar masses.

Now, well into the late 1990s, synthetic rubber has supplanted natural rubber, and found myriad uses in everything from tennis shoes to automobile tires. As synthetic rubber products proliferate, it becomes even more important to be able to characterize them *absolutely* in order to predict their behavior.

The miniDAWN has found a prominent role in these investigations when it has been coupled with Size Exclusion Chromatography (SEC). In this application note, polychloroprene was the synthetic rubber analyzed in THF. With this product especially, the physical properties depend critically upon the high molecular weight components in the sample. Nevertheless, the manufacturer of this product had a problem: the samples could *not* be distinguished by the response from an RI detector nor a viscometer.

The customer selected the miniDAWN and connected it in series with his HPLC system. Not only was the miniDAWN able to isolate the high molecular weight species in the sample, but it was able to determine the molecular *size* of the samples at each elution point.

The figures to the right indicate the differences in the samples. When their differential molar mass and size distributions are plotted, the contrast among the three samples is most apparent.

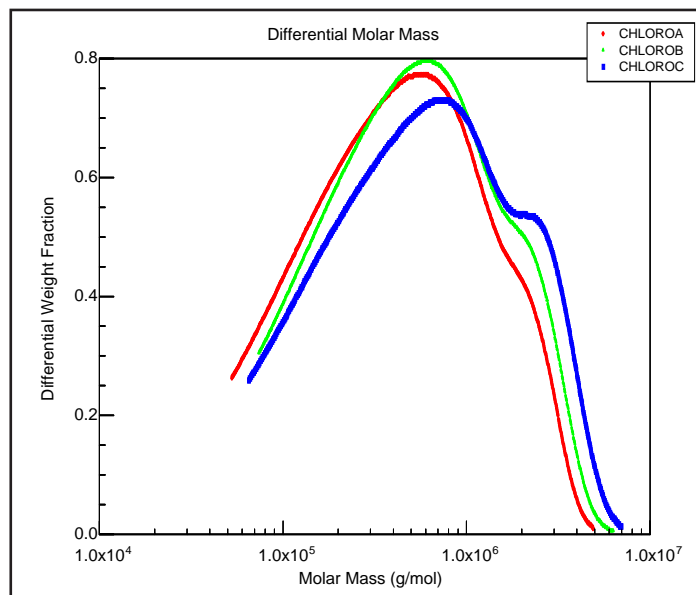


Figure 1. The three polychloroprene samples are easily distinguished by plotting their differential molar masses.

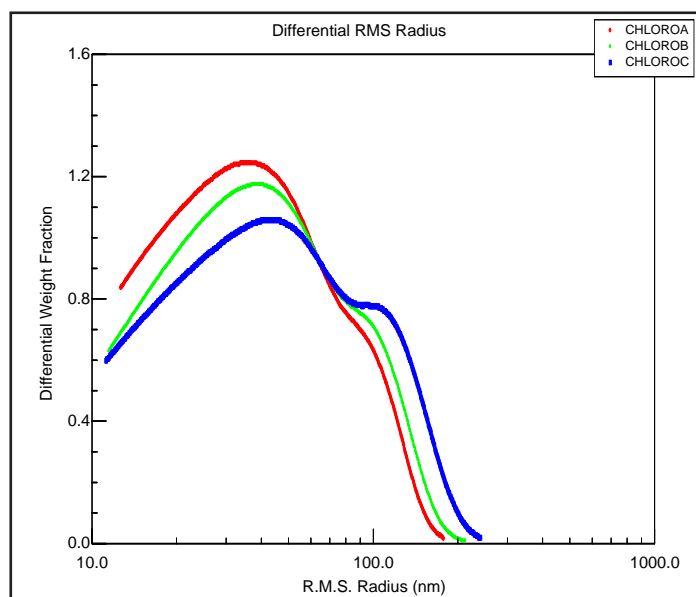
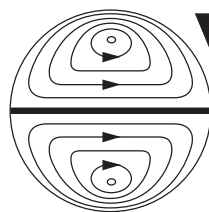


Figure 2. The differential radius distribution also reveals directly the power of the miniDAWN to distinguish similar samples from one another without any dependence on elution volume, conformation or "fudge factors".



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