

Competitive Product Analysis

The Summary

Competitive product analysis and failure analysis are two activities that product engineers face routinely. Two work horses of this approach are microscopy and spectroscopy since the approach relies on collecting samples and analyzing them.

Microscopic techniques are the tools usually relied on when conducting these investigations. These microscopic techniques give information on morphology but what about chemical information?

Chemical Information

In the arsenal of microscopic techniques some tools can give both morphology and chemistry. These tools include:

- Electron Spectroscopy for Chemical Analysis (ESCA)
- Scanning Auger Microanalysis (SAM)
- Energy Dispersive X-Ray Spectroscopy (EDS)
- Microscopic Fourier Transform Infrared Spectroscopy (FTIR)

But aside from micro-FTIR, these tools will determine what elements are there but limited information is available on how the elements are put together. Since many high performance materials are now carbon based, determining the chemistries of these materials (actually analyzing the organic content) is exceedingly important to determine causes of failures.

ORGANIC ANALYSIS TOOLS

Analytical Answers, Inc. has a number of tools strictly devoted to determining the composition or properties of organic materials. Each serves a function in the overall scheme of determining “how it failed”

Fourier Transform Infrared Spectroscopy

Spectroscopy is defined as the study of the interaction of light with matter. Light is defined as not just the area of



the spectrum that we can see but also

In Gas Chromatography the sample of interest is injected onto a long fused silica capillary column and the sample is carried along by a flow of an inert gas typically helium. The sample interacts with a specific coating on the column and is separated based on the polarity of the analyte of interest. More polar compounds “stick” more to a more polar coating and less polar compounds move faster. This is also impacted by the boiling point of the sample; lower boiling compounds move faster than high boilers.

At the end of the column, the eluent goes to a detector. The simplest, detector is a Flame Ionization Detector (FID) and detects organics by burning them. Unfortunately the FID does not give any information about the chemistry of the sample. But the sample can be passed into a specially designed cell before the FID and an FTIR spectrum can be taken on the fly. This then give a spectrum of the pure compound as it comes off the column. This technique is called GC-FTIR and will separate and identify the organic components.

In our synthetic polyester example above, we know now that there is a polyester base polymer identified by FTIR and a filler isolated and quantified by TGA. But the sample feels softer than it should and we suspect that there is some plasticizer in the mix. How do we identify it?

By extracting the sample in the appropriate solvent, then using Gas Chromatography, we can separate the components of the extract. Couple the GC to an FTIR and we can identify what is in the mixture.

Conclusion

Many tools are necessary to characterize organic materials and elucidate how they failed. This brochure shows an example of using some of the tools Analytical Answers, Inc. has in its extensive arsenal.

Other techniques not mentioned here are also available and we look forward to applying the tools and our extensive experience in using the tools to the problems posed by our clients



Analytical Answers, Inc. is a laboratory services company located in Woburn, MA, providing microanalysis, surface characterization and failure analysis. With over 100 years of experience among our scientists and instrumentation capabilities usually only found in large corporate or academic laboratories, Analytical Answers, Inc. can provide data and the expertise to translate that data into knowledge. For more information on Analytical Answers, Inc. please email info@Analyticalanswersinc.com or call (781) 938- 0300.