Contamination Analysis using FTIR Microscopy

There is no industry that is immune to the detrimental effects of contamination. The ability to rapidly conduct failure analyses to identify contaminants enables manufacturers to streamline production and deliver higher quality products. By virtue of its selected area imaging controls, FTIR microscopy is well suited for contamination analysis. In this application note, an illustration of the FTIR shutter control is provided and then the shutters are used to perform selected area imaging of a contaminated adhesive.

Shutters on the microscope can be opened, closed, and rotated to effectively eliminate all signals from unwanted areas of a sample. Shutters are compatible with all FTIR imaging modes (transmission, reflection, and ATR) and their use is illustrated in Figure 1. In Figure 1, a catheter with a metallic support grid was placed under the microscope. The operator can control the shutter position such that only signal from the support grid reaches the detector (Figure 1, left) or such that only signal from the polymeric tube reaches the detector (Figure 1, right). Data for the metallic grid is best collected in reflectance mode, and data from the polymeric support is best collected in either ATR or transmission mode; the modes of data collection need not be the same for a given sample.

To illustrate how FTIR microscopy is used for contamination analysis, selected area imaging was used to identify a white contaminant that was found on carbon black tape during an SEM imaging analysis. Once the contaminant was observed (and because SEM/EDS cannot identify chemical structures), FTIR microscopy was used to identify it, and the results are shown in Figure 2. To obtain the spectra of the contaminant, the microscope imaging shutters were adjusted such that the only the contaminant was visible under the imaging window. The sample was then raised into the germanium ATR crystal until a spectrum was observed. The crystal was then cleaned to remove and residue, and the process was repeated for the substrate. It was found

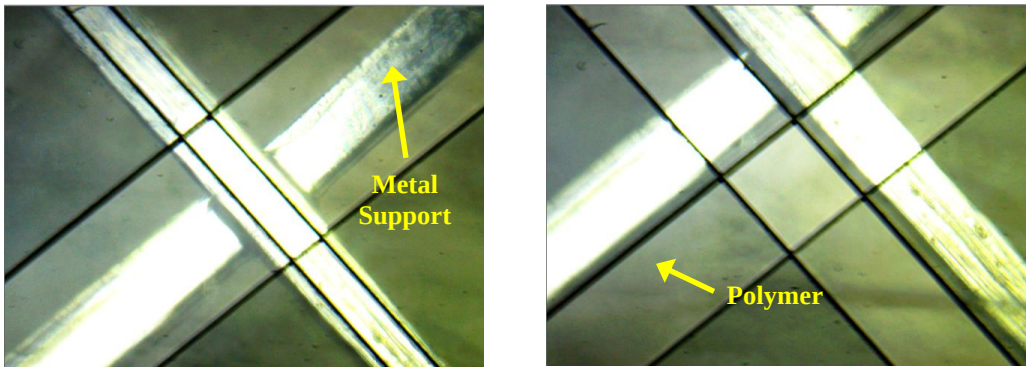

Figure 1. The shutters on the FTIR can be adjusted to exclude or include signal from different areas. In this catheter example, the shutters can be adjusted so that only the metallic support (left) can be investigated or only the polymeric structure (right) can be investigated.

that the carbon fiber tape was primarily comprised of an acrylic resin, while the contaminant was primarily composed of an epoxy resin.

As illustrated, FTIR selected area imaging creates an extremely accessible route for contamination analysis. By simply adjusting the shutters, an operator has complete control over which areas of the sample are characterized and which are not. While this particular example illustrated carbon tape contamination, the process could easily be extended to almost any industry. Furthermore, contamination analysis is just one of many uses of the selected area imaging capabilities. The characterization of multicomponent system will benefit from this feature including catheters, polymer laminates, ink samples, rock inclusions, pharmaceutical tablets, food ingredients, and many others.

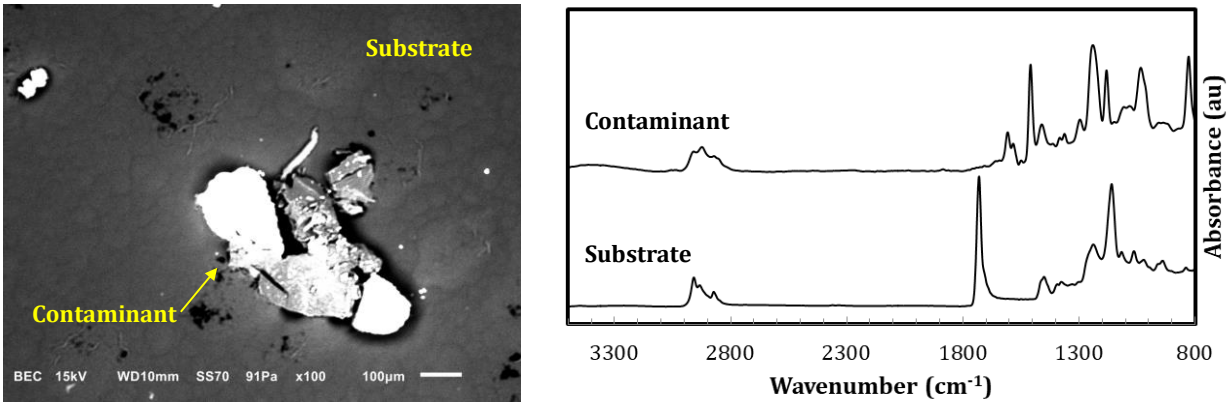

Figure 2. An SEM image of a contaminant particle on a black carbon tape substrate (left). The corresponding selected area spectra obtained using selected-area FTIR microscopy are also shown (right).