FIELD-DEPLOYABLE FTIR FOR PAINT DEGRADATION ANALYSIS

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Fourier transform infrared spectroscopy (FTIR) is a widely-used technique for the analysis of polymer degradation. However, until recently, this powerful analysis method was restricted to the laboratory. With the development of portable FTIR spectrometers, new opportunities have arisen to measure polymer degradation in the field. One of the most common polymer-based materials encountered in our lives is paint, with its degradation having consequences for structural failure due to processes such as corrosion. In this light, we have used field-deployable FTIR for the analysis of paint degradation. From our studies in this area, we have been able to examine the nature of the chemical breakdown of polymer binders in paints. Results from these studies will be presented along with the technological challenges of moving from the laboratory to the field.

With the new opportunities presented by portable FTIR spectrometers, also come new challenges. One of the main challenges that has arisen is maintaining optimal spectrometer/sample alignment throughout spectral acquisitions. In the laboratory, obtaining useful spectra with ‘good’ signal-to-noise is usually a simple matter of increasing the scan time. In the field, however, increasing the scan time to obtain better signal-to-noise may not be such a simple solution. With handheld, portable spectrometers, the operator must maintain optimal spectrometer/sample alignment throughout the acquisition of a spectrum. In our experience with paints, spectra with ‘good’ signal-to-noise are only achievable with scan times of 60 seconds, or greater (see Figure 1). The limit to which an operator can maintain the optimal spectrometer/sample alignment is often hampered by sample point position and spectrometer weight and is around 30 seconds.

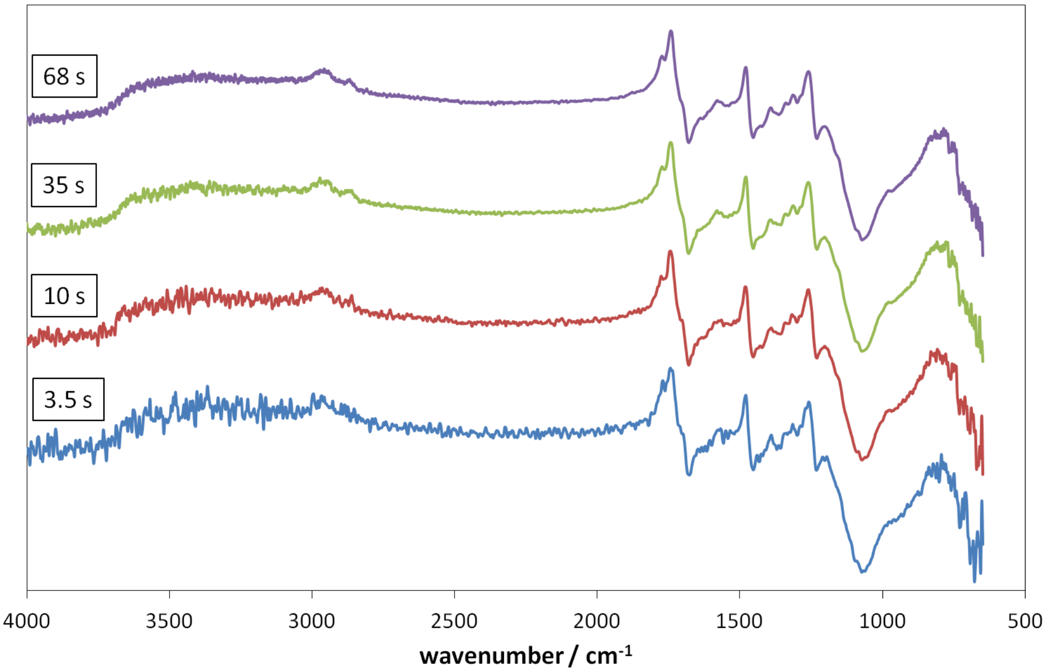

Figure 1 This Figure shows the effect of scan time on signal-to-noise for spectra collected from a polyurethane-based paint using an A2 Exoscan portable FTIR spectrometer equipped with a 45° specular reflectance sampling accessory. The spectra were collected from the same position on the same paint sample, only the scan time was changed. The spectra roughly show an improvement in signal-to-noise that is proportional to the square root of the scan time due to the random nature of the noise[1] in this case.

Therefore, to overcome the scan time limitations of handheld analysis, spectrometer holding and alignment systems have been developed. Werner and Ackerman[2] have designed a simple hook system for supporting a portable FTIR spectrometer during analysis. Their system requires connection of the hook to a substrate; however, this is not always possible in the field. Therefore, we have taken a different approach and built a standalone holding and alignment system for sample surfaces of any angle and a substrate-supported holding and alignment system for flat, level sample surfaces. These systems have allowed for the collection of better quality spectra, which will ultimately lead to more robust analyses.

1. Willard H.H. *et al.*, Instrumental methods of analysis: Seventh Edition. Belmont, California: Wadsworth Inc., 1988, p. 18.
2. Werner G.J. and Ackerman K., Stabilizing device and method for handheld measurement device, US 2009/0120173 A1.