# Degradation of Polymeric Granular Composites


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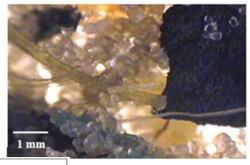
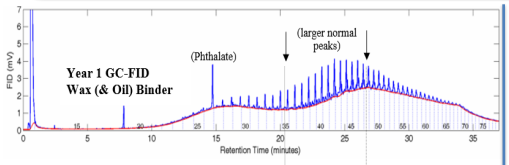
**Project Description:** This ongoing research is centered around the thermal-mechanical characterization and strengthening mechanisms of polymeric granular composites that are used by many Thoroughbred horse racetracks and other equine sports surfaces. Current emphasis is understanding the degradation mechanisms of the material components as they age over time. Testing of the extracted polymeric binder shows that chemical oxidation is occurring which is hypothesized to change the mechanical properties of the track material. These changes, in turn, can adversely affect the racing performance and safety of horse and jockey.

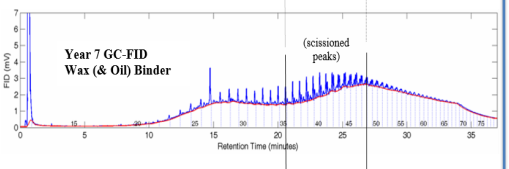


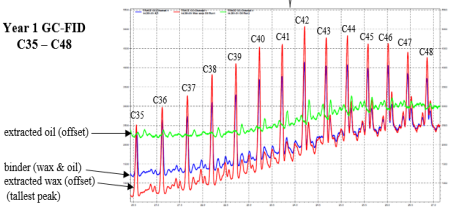
**Desired outcomes:** Learning various testing protocols and the collection of test data over time to further scientific knowledge and to provide recommendations to the equine community on maintaining more consistent surfaces. To become exposed to materials tests to include soxhlet solvent extraction, DSC, GC, FTIR and XRF (X-Ray Fluorescent Spectroscopy). The opportunity to coauthor conference and journal articles.

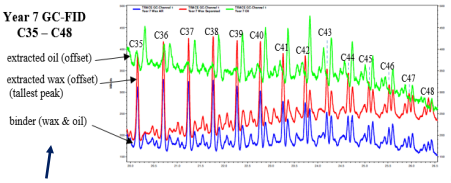



- Silica sand
- Polymer fibers
- Rubber
- High oil/ paraffin-polymer binder

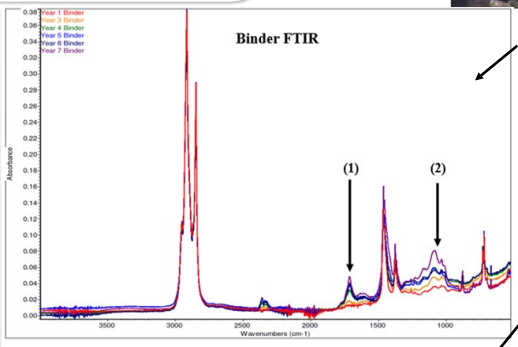


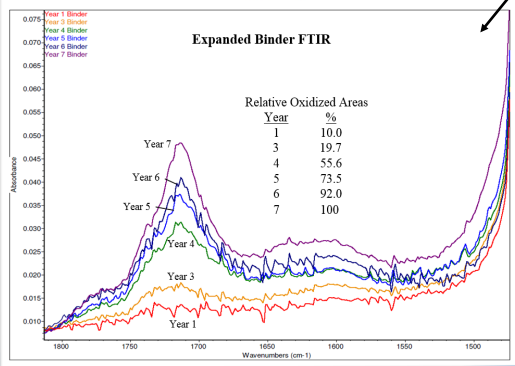



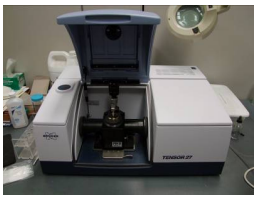

**Gas Chromotagraphy:** Wax binder GC-FID comparison of Year 1 and Year 7 gas chromatography spectrums (top two). Year 1 and 7 extracted wax and extracted oil C35 to C38 spectrums are expanded and superimposed to show distinct trailing peaks not present in Year 1 binder spectrum. In the offset oil scan, the only peaks present are trailing peaks, indicative of oxidized, potentially polar molecules that increase substantially over time



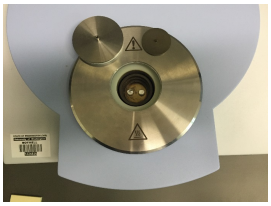

**Fourier Transform Infrared Spectroscopy** (FTIR) results clearly reveal increasing oxidation over time in the 1700 $cm^{-1}$ carbonyl peak wavelength region (2). This oxidation activity is common to aged oils and can be seen in this study to be occurring predominantly within the oil in the wax binder.

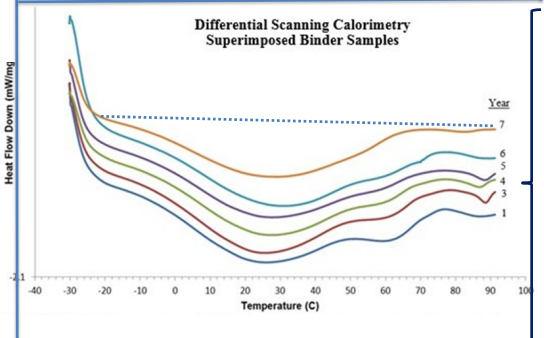



**FTIR Machine**



**DSC Machine**






**DSC** scans of wax/oil binder showing a decrease in melting enthalpy over time. The successive enthalpy decrease suggests a decrease in crystallinity over time which correlates with the scissioning/ fracturing of larger molecules observed in the GC-FID results.

## Research Assistant job duties

- Attend weekly research meeting at UWB
- Assist the PI and chemists/scientists in performing materials testing
- Conduct literature searches/assist with journal articles and technical reports