Case Study

Project Size: Medium ($5,000 – $15,000)
Timeframe: 3 – 6 weeks

FibreCITY
Composites Innovation Centre

Investigation of the Fibre/Resin Interface of an Epoxy Prepreg

Client: A prepreg manufacturer was evaluating a new epoxy chemistry for its out-of-autoclave product line.

Problem: The cured composite properties were not as high as expected based on results from the resin testing. The client wanted to know if there was a compatibility issue between the new chemistry and the sizing on the fibres.

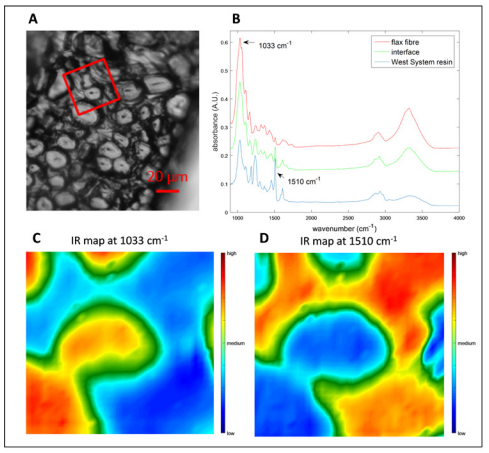
Details:

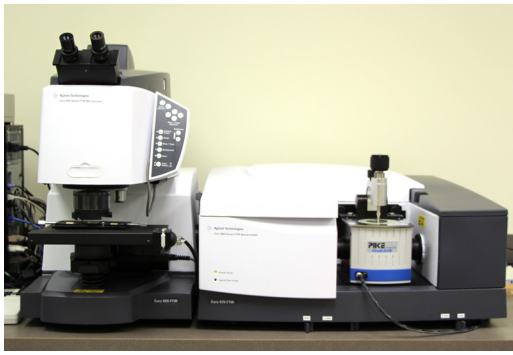
- The new resin and current product were both epoxy resin types.
- The fibre reinforcement remained the same between both the existing and new prepregs.

Recommended Tests & Rationale:

To address the problem, FibreCITY suggested using optical imaging first to determine if micro-voids from insufficient wetting were occurring at the fibre surface. If visual identification could not be found, FTIR spectroscopic mapping could be used to investigate the chemical sources.

- **Axio Imaging** – preliminary assessment of the cured composite samples using high-definition images of the cross-sections of the samples
- **In-situ FTIR Spectroscopic Imaging** – an uncured single-fibre/epoxy mixture sample was clamped between two salt plates and monitored during cure using FTIR imaging
- **Hyperspectral Imaging Analysis** – analyzed the IR chemical images to determine what type of interaction (i.e., micromechanical or chemical) were the dominant forces in the structure of the composite samples





Outcome

Micro-voids could not be found in the samples; however, the results from the in-situ FTIR showed a chemical gradient was present between the fibre surface and the bulk resin. This gradient was characterized by a reduced amount of cross-linking as the resin approached the fibre surface. It was determined that the fibre sizing was likely interfering with the amount of cross-linking needed in the resin to achieve the desired performance.