



PRE-PREG HEALTH AND AGING



For many applications, composite material must be formed into complex shapes and configurations. To accomplish this, fabricators use resin impregnated composite cloth (pre-preg) which is partially cured in order to maintain flexibility, yet strong enough to be used with the requisite molds. In order to inhibit the pre-preg from curing further than desired before actual use, the sheets and rolls of pre-preg are stored in freezers at low temperature, greatly inhibiting the curing process. If pre-preg is stored for long periods of time, even at low temperature, some further curing may occur.

Furthermore, each time a roll of pre-preg is removed from the freezer, some warm up occurs in the unused roll and thus, some unwanted curing may also result. This is the so-called pre-preg "out-time". The combination of out-time and aging has a deleterious effect on the overall health of the pre-preg material. In highly regulated industries, great care is taken to both assure and specify the conditions for acceptable use of the pre-preg.

In recent work carried out with Exoscan and the US Navy, we showed the ability of the Exoscan system to detect changes in pre-preg material that was kept refrigerated for varying time periods of up to two years. Curing is observed in the oldest prepreg as displayed in Figure 1. As the epoxy resin cures, the carbonyl band near 1730 cm^{-1} increases in relative intensity and shifts to a higher frequency. The increase in the carbonyl band is indicative of advanced curing due to storage and out-time.

Since pre-preg is a valuable commodity with critical shelf life considerations, the ability to use a portable analysis tool that can be brought directly to the site of the pre-preg rolls and sheets so that they can be evaluated with respect to oxidation and other aging reactions is critical.

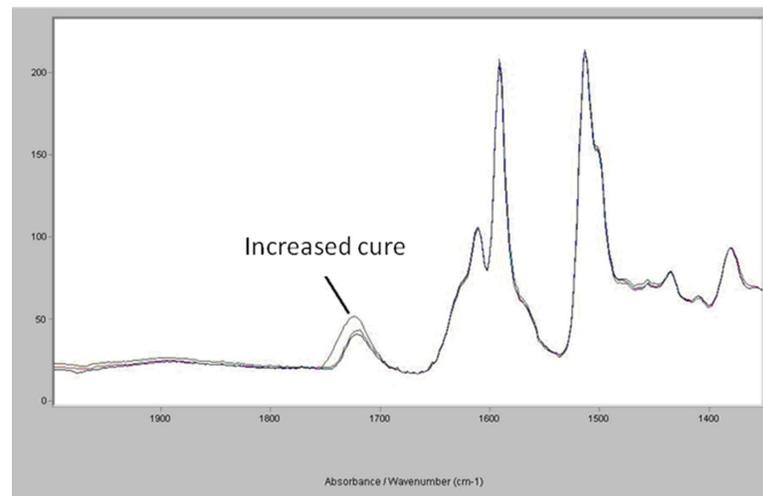


Figure 1- Infrared spectra of pre-preg composite collected with the Exoscan using the ATR sample interface. Advanced curing is shown in the oldest (red) sample as an increase in the carbonyl band intensity.



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