ACOUSTIC EMISSION MONITORING IN COMPOSITES DURING CRYOGENIC THERMAL CYCLING

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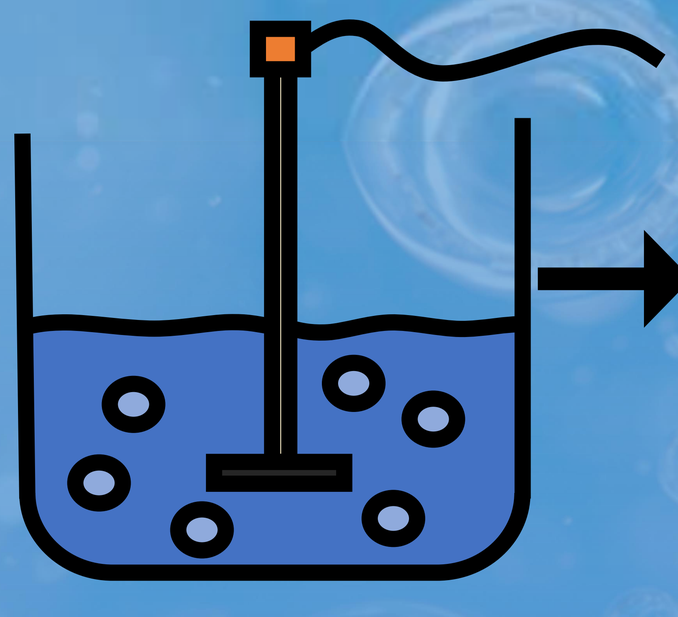
BACKGROUND

- Composites are being considered for liquid hydrogen storage tanks to reduce tank mass.
- Composites tend to microcrack when cooled to cryogenic temperature due to CTE mismatch.
- Monitoring of composite microcracking is of value both in experimental testing and for in–service structural health monitoring.
- Acoustic emissions were investigated as a potential monitoring method.

PROCEDURE

1. Composites were thermally cycled by immersing them in liquid nitrogen.
2. Acoustic emission data was recorded during the cooling and warming.
3. Microcracking was monitored through optical microscopy of polished edges.
4. The acoustic emission data was then analysed in an attempt to differentiate the signals from microcracking and the background fluid boiling
5. Comparisons of the datasets from the two materials were carried out, both using individual waveforms and features extracted from hits.

Investigating the feasibility of **acoustic emission** for monitoring damage in composites during **cryogenic immersion**



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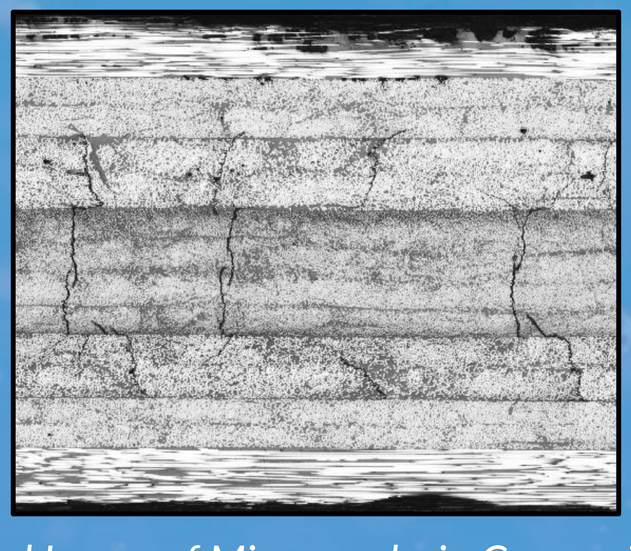
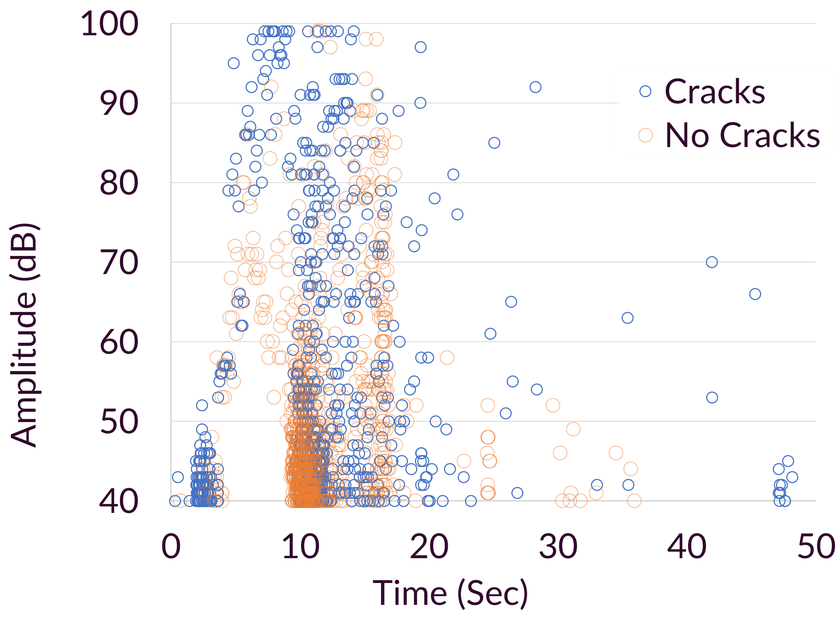


Typical Image of Microcracks in Composite Specimens, Layup $[90_2/45_2/-45_2/0_2]_s$

RESULTS

- Two types of coupons were tested of different polymer matrix constituents, with one type microcracking and the other not cracking.
- The signals for a single thermal cycle of each type of coupon were compared and attempts were made to differentiate the signals



Amplitude Vs Time for AE Hits

CONCLUSIONS

- There were no discernable differences in the signals from the coupons which cracked and coupons that did not crack.
- The signals from the fluid boiling mask any signals from the microcracking. Further analysis is underway to trial different signal processing techniques.

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