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Interactive comment on "Effects of moisture absorption on damage progression and strength of unidirectional and cross-ply fiberglass-epoxy composites" *by* Jake D. Nunemaker et al.

Anonymous Referee #1

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1 General comments

The paper is well written and the topic is quite relevant. Hygrothermal aging of composites still has a significant number of open questions despite many years of existing research. The combination of techniques employed by the authors and the use of different layups allow for a number of interesting clues about hygrothermal degradation to be obtained. However, a number of improvements (listed below) would help augment the scientific value of the paper and make it more suitable for publication.

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Discussion paper

2 Specific comments

- Page 2, line 5: The authors avoid aging at very high temperatures in order to avoid chemically degrading the resin. However, it is also important to acknowledge that aging at 50C can accelerate the chemical degradation of the interface (also mentioned by the authors in line 15). Even avoiding exceedingly high temperatures, it is still risky to assume that specimens saturated at room temperature and 50C have the same degradation level.

- Page 4, line 5: Which tab material did the authors apply? If the tabs also take water this would affect the results of Figure 1.

- Page 4, Fig. 1: The plateau in the diffusion curves mentioned by the authors is difficult to see. In particular, the time interval between the last two measurements seems quite short. How can the authors be sure saturation was reached? Also, did the authors perform an initial drying of the samples before conditioning? If the samples had some initial amount of water when immersion started, the values for m_∞ might be higher than measured. Such an initial drying would also be important to ensure samples labeled as 'dry' provide a moisture-free reference for the study. If not, the authors could label the 'dry' samples as 'as-manufactured' so the reader has a clear idea of the sample condition upon testing.

- Page 8, line 7: Would reorientation of the backing fibers towards the loading direction be another possible explanation for this gain in stiffness?

- Page 13, lines 10-12: Where in the peak frequency analysis did the authors correlate a certain frequency to matrix damage? In general, which frequencies should one expect for each damage type? Is there a clear pattern across material systems and specimen types? The unfamiliar reader is not capable of discerning any information about failure other than the number of events when looking at

Figures 10 and 11 alone. Perhaps a slightly extended discussion on the subject would be interesting.

- Page 15, Discussion: One important degradation driver missing from this discussion that helps explain the observed changes in strength and failure strain is the presence of differential swelling stresses. Since the fibers do not take water and the resin around them swells, significant stress concentrations are created which might help explain the lower failure strain observed in saturated specimens. Furthermore, experimental evidence suggests that resin degradation (at this temperature mainly through plasticization) would not translate to a reduced failure strain, but rather to proportional reductions in stiffness and strength.

3 Technical corrections

- Page 4, Equation 1: The subscript in m_{i} should be written upright, since it is not a variable.
- Page 5, line 5: Please use mm/min and mm instead of in/min and inch in order to keep the units consistent with Figure 2.

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