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Characteristics of vinyl-ester and carbon fiber composite dry and wet probe by Positron Annihilation Lifetime Spectroscopy MAHMOUD MADANI, RICHARD D. GRANATA, Florida Atlantic University — Carbon fiber composites of vinylester resins, Derakane 8084 and 510A, were studied dry and after water exposure. In this study, positron annihilation lifetime spectroscopy (PALS) was used to investigate the free volume fraction and the size of the free volume voids within the polymer matrix. The relative free volume (fractions replae by of positron lifetime intensities) in VE8084 polymer and in VE510A (Space) polymer were 35.2% and 13.8%, respectively. The free volume lifetime and intensities were determined as a function of the polymer thickness and significant differences were observed in both polymers with versus without post-curing. The effects of water uptake in these materials were also determined by PALS. Water uptake showed a 2% change in intensity of the longer lifetime (1.85 ns) in VE8084 polymer and in VE510A about 1.8%. The longer lifetime intensities in the wet composites were 17.1% in the 8084 polymer and its carbon fiber composite and 7.1% in the 510A polymer and its carbon fiber composite. For composite with 8084 polymer saturated (0.33% water gain) with seawater at 40 or 60 °C, no change in the longer lifetime intensity was observed which indicates no water entered the free volume voids (indicates replace by and) some differences between composite and neat polymer. For 510A resin the third lifetime intensity dropped from 7.1% to 3.9% indicating 48% of the free volume filled with water in the composite only after saturation with seawater with respect to dry one.

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