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Gas Turbine Environmental Cycling on Tensile and Flexural Properties of Carbon/ Cyanate Ester Composite

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Summary

The effect of gas turbine lubricant oil soaking, thermal cycling and their combination on morphology and tension and flexure properties of pultruded composite was studied. Two types of lubricant oils were used: Mil-L-7808 and Mil-L-23699. The three types of environmental conditioning chosen are: (1) oil soaking the rods in Mil-L-7808 and Mil-L-23699 oils for 720 hours; (2) thermal cycling the rods for 100, 200, 400, 600 and 800 cycles; (3) soaking the rods in Mil-L-7808 and Mil-L-23699 oils for 720 hours and then thermal cycling the rods for 600 cycles. Results of these three environmentally aged samples were compared with non-aged samples.

A special furnace was built to simulate high rate of heating/cooling of samples. The heating/cooling rate achieved was about 73A?C/minute. Tension and three-point bend flexure tests were conducted to assess the material degradation due to the environmental conditioning. Optical microscope and SEM analyses were performed to investigate the microstructural changes. Dynamic mechanical analysis (DMA) was conducted to investigate the change in the glass transition temperature (Tg). Microscopic images showed that oil soaking did not affect the morphology, whereas thermal cycling caused widespread fiber-matrix interfacial separation and matrix shrinkage, in addition to signs of matrix oxidation. Oil soaking did not change the Tg of the composite rods. However, thermal cycling increased the Tg from 408A?C to 468A?C. The tensile strength of as-received T650/PT-30 pultruded rod was 1.76 GPa with 4