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Determination of Fatigue Limit in Post Impacted Carbon Fiber Reinforced Epoxy Polymer (CFRP) Specimens Using Self Heating Methodology

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Abstract : This paper presents the experimental identification of the fatigue limit for pristine and impacted Carbon Fiber Reinforced Epoxy polymer (CFRP) woven composites based on the relatively new self-heating methodology for composites. CFRP composites of [0/90]8 and quasi isotropic configurations prepared using hand-layup technique are subjected to low energy impacts (20 J energy) simulating a barely visible impact damage (BVID). Runway debris strike, tool drop or hailstone impact can cause a BVID on an aircraft fuselage made of carbon composites and hence understanding the post-impact fatigue response of CFRP laminates is of immense importance to the aerospace community. The BVID zone on the specimens is characterized using X-ray Tomography technique. Both pristine and impacted specimens are subjected to several blocks of constant amplitude (CA) fatigue loading keeping R-ratio a constant but with increments in the mean loading stress after each block. The number of loading cycles in each block is a subjective parameter and it varies for pristine and impacted CFRP specimens. To monitor the temperature evolution during fatigue loading, thermocouples are pasted on the CFRP specimens at specific locations. The fatigue limit is determined by two strategies, first is by considering the stabilized temperature in every block and second is by considering the change in the temperature slope per block. The results show that both strategies can be adopted to determine the fatigue limit in both pristine and impacted CFRP composites.

Keywords : CFRP, fatigue limit, low energy impact, self-heating, WRM
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