Title

INCREASED FATIGUE LIFE OF SELF-AMELIORATING COMPOSITES USING INKJET PRINTED THERMOPLASTICS

Abstract text

The benefits from implementation of novel and multifunctional composite materials need to be evaluated against their long-term performance and durability in order to fully meet the complex and rigid design criteria, especially in the aerospace industry. Fatigue becomes an extremely important factor to consider where sudden failure could lead to catastrophic consequences. However, due to their complex microstructural stress mechanisms, the damage progression and containment in composites can be challenging to assess and predict.

A new technique developed at The University of Sheffield enabled the accurate deposition of discrete thermoplastic droplets in the interlaminar region prior to lay-up and curing of aerospace accredited advanced carbon fibre composites. Inkjet printing is not manually intensive, and allows precise control over the droplet distribution. Using as little as 0.076%wt, significant increases in interlaminar fracture toughness and shear modulus can be observed. This method also has the capability to extend the endurance of CFRP, by incorporating self-ameliorating properties through this unique combination of thermoplastic enhancement and preservation of the material's structural integrity. This work develops the novel modelling techniques to accurately depict fatigue performance in inkjet printed CFRP to better understand the life extension mechanisms behind these novel systems.

Keywords

FATIGUE, INKJET, CFRP, FEA, FRACTURE TOUGHNESS, ENDURANCE, MULTIFUNCTIONAL COMPOSITES, TOUGHENING, MULTI SCALE MODELLING

Authors 4

CARTLEDGE, ANDREW (THE UNIVERSITY OF SHEFFIELD // DEPARTMENT OF MECHANICAL ENGINEERING)

PINNA, CHRISTOPHE (THE UNIVERSITY OF SHEFFIELD // DEPARTMENT OF MECHANICAL ENGINEERING)

SMITH, PATRICK (THE UNIVERSITY OF SHEFFIELD // DEPARTMENT OF MECHANICAL ENGINEERING)

HODZIC, ALMA (THE UNIVERSITY OF SHEFFIELD // ADVANCED MANUFACTURING RESEARCH CENTRE)