TOWARD AN EMPIRICAL MODEL FOR IMPACT DAMAGE MORPHOLOGY IN PLATES SUPPORTED BY A CIRCULAR BOUNDARY

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Abstract: Impact damage continues to drive sizing of modern composite aircraft components owing to the significant reductions in static strength it can cause. Despite morphology of damage being critical to determining residual strength, and decades of research, analytical design tools for impact damage morphology do not yet exist. To this end, post-impact and in-situ X-ray CT together with repeated C-scans are used to investigate both the energy at which delaminations initiate and the rate at which growth occurs during dynamic and quasi-static impact tests. Laminates with various different stacking sequences, materials and thicknesses are considered. Results show that the morphology of delamination caused by impact damage at each interface depends on the fibre angle of plies bounding the interface and is independent of the overall stacking sequence of the laminate, ply-percentages, the through-the-thickness location of the delamination within the laminate and impact energy. Conversely, the extent of delamination at each interface was found to vary with the location of the interface within the stacking sequence. Rate of growth of delamination with increasing impact energy is shown to vary with the difference in ply angle at an interface and some correlation is seen with through thickness distribution of bending and shear stresses during impact. The impact energy level at which delaminations initiate is shown to increase broadly in-line with the total fibre miss-match angle of the coupon which is defined as the sum over the full stacking sequence of the mismatch angle at each interface.

Keywords: silver nanoparticles, microfiltration, membranes, biocidal effect