Paper ID: 80883
student

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Manufacturing and industrialization for Launch Vehicle and Space Vehicle Structures and components (High volume production, industrialization, automatization and digitalization) (7)

Author: Ms. Tasneem Fatima
UNSW Australia, Australia

SCRAP RECYCLING POTENTIAL OF PREPREG COMPOSITES

Abstract

The increase in composite use has led to a proportional increase in waste. The question to be investigated during this thesis is understanding techniques to make scrap prepreg recycling an automated process while using techniques to increase the mechanical strength of the scrap laminate. This will be conducted using randomized scrap layup with the intention to automate the process, using heat to increase specimen flexibility and using tensile, compression and shear testing to understand mechanical properties.

A decrease in mechanical properties, as seen particularly from an experiment conducted by the Technological institute of Aeronautics in Brazil, is expected. However, the aim is to improve existing experiments by cutting the scraps into similar shapes and curing the sheet at a higher temperature to distribute the stress more evenly throughout the specimens. An increase in mechanical properties from both the Boeing and The BRTA experiments is expected. The process's automation will be conducted through simplified layup methods to produce a laminate sheet. The randomized layup will be conducted to mimic an automated fibre layup placement and as a depiction of how companies with copious quantities of scrap can opt to recycle and can make the process more efficient. Mechanical processes are the most energy-efficient; however, the intention is to make the process easier and scalable. As there is a randomized layup, there must be multiple specimens created to produce an effective average result of the testing stages.

The testing of the specimens will be conducted using the composites lab with the machines designed for tensile stress, compressive stress, and shear stress. For each test, there will be 15 specimens tested. During the manufacturing process, at least 80 specimens will be created, and the most identical 45 of these sequences will be selected and tested on the three primary methods (tensile, compressive, and shear). The quality of these specimens will be found based on weight, size, visual inspection, and ultrasonic inspection. The worst specimens with uneven layup or minor defaults will also be tested to understand how they can take load compared to the better-manufactured parts.

If this method is implemented by industry, there are imperfections expected as the sheet is no longer continuous; voids, fibre fracture, and porosity are common problems in conscious sheets, so their effect on scraps is a valuable test to understand the limitations of this technique in industrial applications.