A study on the defects in the lay-up process of prepreg-based carbon fiber composites

Zahra Hooshmand-Ahoor*†[1], Kevin Jose[1], Tiancheng Huang[1], and Vikram Deshpande[1]

[1]Department of Engineering, Cambridge University – United Kingdom

Abstract

Carbon fiber reinforced polymer (CFRP) composites are widely used in aerospace, automotive, and marine industries due to their high strength-to-weight ratio, fatigue resistance, and corrosion tolerance. Prepreg materials, with carbon fibers pre-impregnated with partially cured resin, enable precise control over fiber alignment and resin content, enhancing mechanical performance. However, the manufacturing process of prepreg-based composites presents several challenges, including the formation of voids, wrinkles, and other interlaminar imperfections. These defects can significantly undermine the structural integrity and performance of the final composite, particularly under high-stress conditions. This study examines the impact of defects in the lay-up process of partially cured prepegs. The materials selected for this investigation are commonly used in advanced applications, particularly in aerospace. IM7 carbon fibers and 8552 epoxy resin have been chosen as the primary components of the CFRP composite. X-ray computed tomography (XCT) is employed to analyze the microstructure and identify defects, such as shear strains between layers caused by voids. The results aim to provide insights into optimizing the lay-up process and understanding how defects affect the mechanical properties of laminates, particularly when shaped into complex geometries.

*Speaker

†Corresponding author: zh419@cam.ac.uk