Evaluation of the strain gradient effect on compressive failure of CRFP composites

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Abstract

A pin-ended buckling test, inspired by Wisnom (M. Wisnom, 1992), was designed to examine the influence of strain gradients on the compressive failure strain of composite laminates. The study focused on unidirectional (UD) carbon/epoxy AS4/8552, with strain measurements obtained via digital image correlation. Cross-ply stacking sequences-((0/90))s, ((0/90))s, ((0/90))s-as well as unidirectional configurations (0) and (0) were tested to explore the impact of specimen thickness on compressive failure strain. Most specimens failed on the tension side, driven by the high compressive strength induced by the strain gradient, while the tensile failure strain remained unaffected. To provoke failure on the compression side, an innovative approach was employed by adding an aluminum 2024 ply to the top tension side of bi-material specimens, resulting in all specimens failing on the compression side. The findings revealed a non-linear relationship between compressive failure strain and the strain gradient, contrasting with Wisnom's linear trend. Furthermore, we've obtained for the thinner specimens, values that go up to -33000 micro strains, which is more than 2.5 times the compressive failure of -12500 micro strains. Wisnom, M. 1992. " On the High Compressive Strains Achieved in Bending Tests on Unidirectional Carbon-Fibre/Epoxy ". *Composites Science and Technology* 43 (3): 229-35. https://doi.org/10.1016/0266-3538(92)90093-I.

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