

Highlights:

The innovative contributions of this paper can be summarized as follows:

- For fracture ply splice mechanisms: the strength, fracture mode and fracture mechanisms of CFRPs with ply splicing were studied in detailed, and the effects of junction geometry and ply angle were determined.
- For unidirectional and $\pm 30^\circ$ laminates, the ply splice structure should be well designed as the ply splicing decreases significantly the strength; however, for $\pm 45^\circ$ and $\pm 60^\circ$ laminates, the effect of ply splicing can be ignored.
- For testing methods: the strain distribution of a narrow area (a width of only 2 mm) was successfully tested using a digital image correlation technique, and the fracture modes were determined using an acoustic emission technique.