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Numerical evaluation of the influence of porosity on bending properties of 2D carbon/carbon composites

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ABSTRACT:

Numerical simulation with progressive damage criterion is implemented to investigate the effect of porosity on the bending properties of 2D cross-ply carbon/carbon (C/C) composites. The mechanical properties of Pyrocarbon matrix regarding the change of porosity are calculated by using Mori-Tanaka approach. Combining with the stiffness degradation scheme, the ultimate bending strengths are calculated in Abaqus though a user-defined subroutine (USDFLD). Delamination is modelled by inserting cohesive elements between two adjacent plies. A good agreement is obtained when the FEM results are compared to three-point bending experiments. The FEM results show that the bending strength decreases greatly with the increase of porosity. When the porosity reaches up to 18%, the bending strength is decreased by 57%. The major fracture behaviors are interlamination delamination and continuous crack damage in 90˚ plies. With the increase of porosity, more severe interlamination delamination will be slightly aggravated. In addition, the increase of porosity will also accelerate the damage in 90˚ plies.

Keywords: 2D C/C composites; Numerical simulation; Flexural properties; Progressive damage

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