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Determination of Strain-Dependent Interlaminar Shear Modulus of Carbon-Carbon Composite Material

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Abstract

Carbon-carbon composite materials can exhibit nonlinear behavior in some loading scenarios and at some elevated temperatures. The nonlinear load-deflection curve for a simply-supported carbon-carbon beam subjected to four-point bending was investigated to determine if the causes for the nonlinearity stem from nonlinear extensional stress-strain behavior or from nonlinear interlaminar shear stress-strain response. Carbon-carbon beams of two different thicknesses of the same span length were fabricated and tested, and analyses were performed to correlate the measured deflections with calculated displacements. It was determined that the flexural response of the carbon-carbon beams was best modeled using models employing shear deformation behavior. The effective interlaminar strain-dependent shear modulus of the carbon-carbon material was back-calculated from the test data correlation analyses.