Interfacial Shear and Peeling Stresses in Notched Multilayered Assembly under 4-Point Bending Test

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Abstract

This manuscript presents analytical modeling of peeling and shear stresses in multi-layer 4-point bending specimens. Strength of materials approach with the assumption of small strains, within elastic region, is adopted in this study for evaluation of stresses and displacements. Furthermore, equations that describe moments and shear forces in the assembly due to four-point bending load are developed based on beam theory. Second and fourth ordered differential equations are derived for shear and peeling stresses respectively at the interfaces of the assembly. Boundary conditions are determined based on the assembly geometry and loading condition. The governing differential equations are instantaneously solved to obtain the problem solution. The solution is compared with and verified using Finite-Element-based simulation. Four-point bending test is usually used to determine the fracture toughness or critical energy release rate for interface or bond material. This work presents an alternative approach where the stresses at the notch are used to determine the fracture toughness. The approach is verified using a four-point bending test conducted for interface intermetallic material and is validated using the conventional techniques.