Interfaces between a fibre and its matrix

The interface between a fibre and its matrix represents an important element in the characterization and exploitation of composite materials. Both theoretical models and analyses of experimental data have been presented in the literature since modern composites were developed and many experiments have been performed. A large volume of results for a wide range of composite systems exists, but rather little comparison and potential consistency have been reached for fibres and/or for matrices. Recently a materials mechanics approach has been presented to describe the interface by three parameters, the interfacial energy [J/m²], the interfacial frictional shear stress [MPa] and the mismatch strain [-] between fibre and matrix. The model has been used for the different modes of fibre pull-out and fibre fragmentation. In this paper it is demonstrated that the governing equations for the experimental parameters (applied load, debond length and relative fibre/matrix displacement) are rather similar for these test modes. A simplified analysis allows the direct determination of the three interface parameters from two plots for the experimental data. The complete analysis is demonstrated for steel fibres in polyester matrix. The analysis of existing experimental literature data is demonstrated for steel fibres in epoxy matrix and for tungsten wires in copper matrix. These latter incomplete analyses show that some results can be obtained even if all three experimental parameters are not recorded.

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Contributors: Lilholt, H., Sørensen, B. F.
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