Implementation of the Coupled Criterion (CC) in its asymptotic form (i.e., based on Williams' type series expansion) to predict the growth of the crack along the adhesive bonded interface

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Relevant Working Groups: WG4

Objectives / Description / Main outcomes

The aim of the Mission was to learn and develop a reliable computational analysis based on Finite Fracture Mechanics (FFM) to evaluate the mode II of fracture mechanics carried out with a End Notched Flexure test (Fig. 1) in adhesively bonded interfaces under frictional sliding contact. It is studied the influence of the frictional coefficient and the relation of the elastic modulus of the bimaterial with the necessary critical load to make the crack grow.

A Finite Element analysis is performed for different combination of materials and frictional coefficient. For each analysis the shear stress along the expected crack path, the potential energy, and the dissipated energy due to friction are computed. With these values the Coupled Criterion (CC) is applied to get for each combination of materials and frictional coefficient the critical load and critical crack length (Fig.2). The CC is fulfilled when both criteria, the stress and the energy, are fulfilled at the same time as shown in (Fig.2).

Once that all the results can be compared, conclusions about the influence of the different parameters can be drawn. Also, by comparing the results with experimental tests found in the literature, the use of the CC can be verified for the prediction of the grow of crack along the adhesive bonded interface under mode II of fracture mechanics.

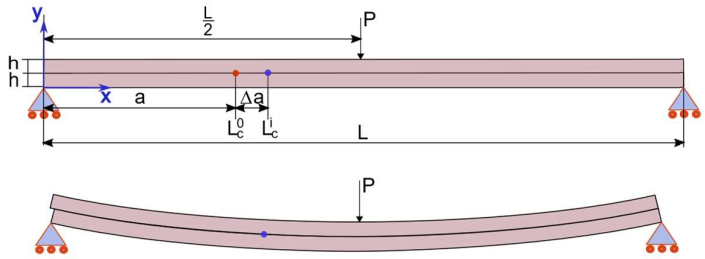

Figure 1 *End Notched Flexure specimen schema with boundary conditions and applied load before and after the load is applied. The red dot marks the pre-crack tip and the blue dot the crack tip after applying the critical load.*

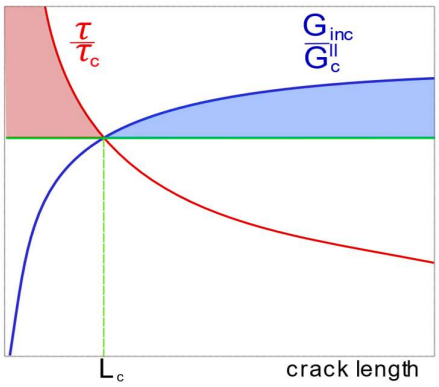

Figure 2: *Schematic representation of the CC in case of a weak singularity. Stress to strength ratio and incremental energy release rate to fracture toughness ratio as a function of a the crack length for a determined load*