

ABSTRACT

Dialogues between (Brittle) Polymer Fracture Descriptions: Gaining Insight from Models Cross-Over and Experiments on PMMA

R. Estevez¹, A Doitrand², D. Leguillon, A. Gravouil³, G. Molnar³

¹ Université de Grenoble Alpes, Grenoble INP, CNRS, SIMaP, F-38000 Grenoble
 ² Université de Lyon, INSA Lyon, CNRS, MATEIS, F-69000 Lyon
 ³ Université de Lyon, INSA Lyon, CNRS, LaMCoS, F-69000 Lyon

We present a coupled experimental and theoretical analysis of failure in brittle materials, PMMA being a case study. We examine fracture emanating from V-notch instead of a natural crack commonly considered in fracture mechanics. Plates containing Rhombus holes are investigated experimentally, under uniaxial compression. A two steps crack propagation is observed, with a first abrupt crack initiation followed by controlled crack growth. The force at crack initiation decreases and the extent of spontaneous crack increases with notch angle. This is investigated by comparing a cohesive model description and the coupled criterion framework. Once the parameters calibrated, both descriptions are able to capture the main experimental features. The influence of the cohesive traction-separation profile on the predictions is examined. Some comments on the identification of parameters involved in a phase fields description for failure will be reported.

[1] A Doitrand, R Estevez, D Leguillon, European Journal of Mechanics-A/Solids 76, 290-299 (2019).
[2] A. Doitrand, R. Estevez, D. Leguillon, Theoretical and Applied Fracture Mechanics, 99: 51-59 (2019).

[3] G. Molnár; A. Doitrand; R. Estevez; A. Gravouil, ,Comptes Rendus. Mécanique, 353, 91-111 (2025).