6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

EXPERIMENTAL AND NUMERICAL INVESTIGATION OF CRACK GROWTH IN POLYETHYLENE

Martin Kroon

Linnaeus University, Växjö, martin.kroon@lnu.se

Key Words: *polyethylene, fracture, crack, dynamic, cohesive zone.*

Crack growth in semi-crystalline polymers, represented by polyethylene, is considered. The material considered comes in plates that had been created through an injection-molding process. Hence, the material was taken to be orthotropic. Material directions were identified as MD: molding direction, CD: transverse direction, TD: thickness direction. Uniaxial tensile testing was performed in order to establish the direction-specific elastic-plastic behaviour of the polymer. In addition, the fracture mechanics properties of the material was determined by performing fracture mechanics testing on plates with side cracks of different lengths. The fracture mechanics tests were filmed using a video camera. Based on this information, the force vs. load-line displacement could be established for the fracture mechanics tests, in which also the current length of the crack was indicated, since crack growth took place. Crack growth was modelled using a rate-dependent cohesive zone. The problem was analyzed using Abaqus, and the crack growth experiments were simulated. The experiments could be well reproduced. Furthermore, the direction-specific work of fracture had been established from the experiments and these energies could be compared to the values of the J-integral from the simulations for the different crack lengths.