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Fracture Energy Corresponding to the Puncture/Cutting of Nitrile Rubber by Pointed Blades

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Abstract : Resistance to combined puncture/cutting by pointed blades is an important property of gloves materials. The purpose of this study is to propose an approach derived from the fracture mechanics theory to calculate the fracture energy associated to the puncture/cutting of nitrile rubber. The proposed approach is also based on the application of a sample pre-strained during the puncture/cutting test in order to remove the contribution of friction. It was validated with two different pointed blade angles of 22.5° and 35°. Results show that the applied total fracture energy corresponding to puncture/cutting is controlled by three energies, one is the fracture energy or the intrinsic strength of the material, the other reflects the friction energy between a pointed blade and the material. For an applied pre-strain energy (or tearing energy) of high value, the friction energy is completely removed. Without friction, the total fracture energy is constant. In that case, the fracture contribution of the tearing energy is marginal. Growth of the crack is thus completely caused by the puncture/cutting by a pointed blade. Finally, results suggest that the value of the fracture energy corresponding to puncture/cutting by pointed blades is obtained at a frictional contribution of zero.

Keywords : elastomer, energy, fracture, friction, pointed blades
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