
Percolation model of micro-defects accumulation and forced elasticity area collapse before the crack fracture front in polymer and composite materials

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The results of this study allow us to follow qualitatively and quantitatively all the induced elasticity evolution stages before the crack front zone in polymeric materials. They are: zone formation, micro-defects emergence, holes and their elastic field, interaction of the holes, holes binding and fusion and the clusters formation, the holes' emergence process, kinetics at the initial and advanced stages. In this paper we consider the elastic zone evolution final stage: the formation of infinite holes' cluster and the elastic band collapse. The study considers induced elasticity zone hierarchical structure, formulates elastic band collapse percolation test, and obtains an oriented amorphous-crystalline fiber concentration failure criterion and the resulting elastic band percolation test collapse similar to known in the literature. The ratio of these criteria is a universal constant with accuracy of 2.58. Close to collapse almost all the holes are in a bound state, and the elastic band is riddled in all directions with cracks network – channels that connect the holes. At the collapse time the share of "damaged" holes of the elastic band is not more than 30% of the entire area, and it is riddled with channels and connecting holes.

Keywords: crack, induced elasticity zone, micro-defects-holes, percolation, an infinite cluster, the elastic band collaps.

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