New micromechanism of fracture in polymeric composites materials

E.N. Kablov[1] V.B. Litvinov[2], I.S. Deev[1] P.A. Belov[2], L.P. Kobetz[2]

[1]All-Russian Institute of Aviation Materials, Moscow, Russia
e-mail: admin@viam.ru

[2]JSC Scientific and Production Concern “Composite Materials and Technologies, Moscow, Russia
e-mail: mail@emtc.ru

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Fractographic study of fracture of fibrous polymeric composites materials has shown that it is characterized by the formation of cylindrical pieces - a kind of "torsion" local areas of the matrix microstructure. Configuration "torsion" varies depending on the conditions of capacity, nesting, diameter and the fibers nature, distance between fibers, the adhesion power of material components drag.

Bending of polymeric composites materials it is observed the change of rotation direction of “torsion” due to the action of indenter. Increased adhesion of the matrix to the fiber causes a smaller radius of the «torsion» and collapses them into smaller ones directly at the fiber surface. Fractographic study of polymeric composite materials based on carbon, glass and organic fibers and also nanomodified binders has shown that “torsion” moda of fracture in the process of shifting, tension, compression, transverse separation is universal.

Made an attempt to explain the effect based on the open theory of defective medium. Considered several flat and be-flat contact cases. The reinforcing element is represented as an absolutely rigid half-space - the substrate, the matrix - as an elastic half-space. The line of contact coincides with the axis OX of the Cartesian coordinate system. Matrix contact with the substrate carried on the negative side of the axis OX, the crack coincides with the positive part of the axis OX. The dependence of the diameter and pitch of «torsion» of elastic properties of the matrix and the adhesive properties of a pair of substrate matrix is studied.