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## CHANGE IN THE SHEAR STIFFNESS OF 3D-REINFORCED CARBON PLASTICS AT A LOW-VELOCITY IMPACT

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One of distinctive features of carbon-carbon composites is their low crack resistance due to the brittleness of the carbon matrix. At the same time, low-velocity impact loadings are widely met in actual practice. Therefore, a successful use of carbon-carbon composites requires investigations into their behavior under the action of this type of loading. The prime objectives of the present work were (a) to establish a relationship between the dimensions of the zone of possible delaminations and the stresses caused by the impact energy and (b) to elaborate an approach to evaluating the damageability of the composite materials upon the action low-velocity impacts which would allow one to obtain steady and repeatable results at a certain level of impact loading. To determine the dimensions of the zone of possible delaminations and the magnitude of stresses as functions of impact energy, a FE analysis was carried out. The distributions of contact stresses were assumed according to the Herz theory. In the case of spherical striker, the contact pressure  $p(x,y)$  is distributed ellipsoidally in a circular zone of radius  $a$ , which depends on the total contact force  $P$  and the striker radius  $R$ . At the first stage, a relationship between the impact energy and the resultant of contact stresses (the contact force) was established. The calculation was performed by the method of successive approximations, with a gradual increase in the contact force. At the second stage, the dimensions of the zone of possible delaminations and the stress state caused by the contact force  $P_k$  corresponding to a prescribed impact energy were determined. Assuming that the material loses its load-carrying ability in the zone where the equivalent Mises-Hill stresses exceed the ultimate strength  $\sigma_{ekv} > \sigma_p$ , during the impact, at the third stage, a model of the damaged object was formed by employing the approach described in [1]. By using the FEM, the deflection  $w_p$  was found at the point where the load was applied to the undamaged and impacted object loaded according to the three-point scheme. Then, the shear stiffness of the undamaged and impacted objects were calculated [2]. As the object of investigation, a square in plane carbon-carbon composite specimen with known mechanical characteristics was taken. The specimen was subjected to a low-velocity compressive or bending load. For various side-thickness ratios of the specimen, relationships for decreasing shear stiffness of the material as a function of a low-velocity compressive or bending impact were obtained.

### REFERENCES

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