ADHESION MECHANICS OF POLYMER COMPOSITES

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Considerable growth in application of polymer composites and glues necessitated appearance of specific division of solid state mechanics – adhesion mechanics, describing behavior of materials in the interfacial area as a result of interaction of components. In case of composites the adhesion mechanics means composite micromechanics, thus classic macromechanics considers composite as a homogeneous (in average) continuum. Unlike macromechanics, in which analysis of solids behavior starts from the study of simplest case - uniform stress state, the micromechanics always deals with not-uniform stress state, at that not-uniformity may be strongly expressed in the form of stress concentration. That feature determines objective complexity of adhesion mechanics, and is the main reason of noticeable gap between theory and practical experimental results. Rapid development of new materials - polymer nanocomposites demands new experimental techniques for adhesion interaction studies and new approaches in theory of adhesion applicable for nanoparticles.

Another important point – contacts characteristics of adhesion bond, also connected with not-uniformity of stresses. Experience in adhesion studies proves the necessity in formulation of hypothesis about influence of bond density and energy in the contact area on stress-strain state not only of interface, but the contacting bodies themselves.

The next points – analysis of temper (technological) stresses and their influence on mechanical behavior of adhesion bonds, selection of criteria and estimation of true adhesion strength for adhesion bonds models and discrete models of composites and viscoelastic behavior of adhesive in thin layers between rigid substrates.

At last – very important, but relatively little explored – study of mechanical behavior of adhesion bonds in dynamic stress conditions.

In the present work all these points are considered by means of solution the major tasks in stress state for various models of adhesion bonds mainly by means of contact layer in comparison of theory with experimental data.