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NEW POSSIBILITIES IN CREATING OF EFFECTIVE COMPOSITE SIZE-STABLE HONEYCOMB STRUCTURES DESIGNED FOR SPACE PURPOSES

Abstract

A great necessity for the optimal designing and manufacturing of size-stable and precision structures for satellite communication systems and sensing systems has arisen for the successful implementation of the international space programs. It is known that the sandwich panel with load-bearing layers made of polymer composites based on carbon, organic or glass fibers and honeycomb filler of aluminum foil or other materials have a high size-stability.

This class of structures is exposed to large overload during the launching, vibration effects and thermal cycling in the specific conditions of space. Providing of minimum weight and maximum stiffness under these conditions of the size-stable composite honeycomb structures designed for space purposes is due to a number of features and problems in their production.

The main trend in designing and producing of ultra-strong and size-stable sandwich structures based on carbon filler has been shown for the product intended for use in space.

Optimization of the design parameters was performed on a sample of real section of the composite solar panel with honeycomb filler. Results of the analysis of different reinforcement schemes for load-bearing layers and rational distribution of material for several load cases were presented.

Analysis and assessment of technological warpage of these panels was carried out. The causes of defects generated during the manufacturing process in the form of continuous and discrete strips of thin CFRP load-bearing skins were also investigated.

Complex investigation of adhesive joint's bearing capacity of composite skins with a honeycomb filler at transverse avulsion for the main technological methods of applying the glue (in the form of a continuous layer and targeted dosing to the ends of the honeycomb) was carried out by the analytical method and using finite element method. The obtained results allow predicting the fracture behavior of the compound of load-bearing layers with honeycomb core depending on the parameters and material properties of the honeycomb and the adhesive layer.

Optimization of the design parameters of the solar panel's composite section with honeycomb filler have predicted its surface mass at level 0.6 kg/m.sq. if implementing of modern achievements in the field of polymer composite materials and manufacturing technologies of composite structures.

It is noted that the use of CFRP as a material of filler can significantly increase the efficiency of the thermo-stable and size-stable aggregates for space technology and allows recommending specific objects that implement the obtained results.