

1.10.40. THE MODE USED FOR THE ESTIMATION OF THE TECHNICAL CONDITION FOR THE BOAT HULL FROM COMPOSITE MATERIALS FOR EXPLOITATION

Frantsev M.E., Neptun-Sudomontasch, Moscow, Russia

The control of the dynamics of the progress of the different defects in the boat hulls for the exploitation is appeared one of the other reliable criterions of the estimation of the technical condition of these hulls with the practice of the world shipping. The progress of the defects in the hull's construction reduces its quality of the safety. In addition to brings down the faculty to the resist unfavourable influences for the exploitation.

As a rule the size of the defect is, define with the changes of the geometry dimensions of the cross-section of the boat hull elements. These changes bring to the decrease of the mechanical descriptions (the area of the cross-section and the inertia moment and others) for boat hulls, which were making of the steel or the aluminium.

The stresses that function in the construction are bigger than the breaking points if the size of the defect exceeds the limit size.

In such a case, the construction can collapse for the rated speed. In addition to the zone of the emergency destruction is able to have the disproportionately big size in the supernumerary situations for the exploitation.

The boats that have the hulls of the compositions materials especially the fibreglass boats are biggest part of the world small fleet now.

It is known that the reinforced plastics are the compound materials that have two components. There are the matrix and the reinforced material.

The fibreglass does not change the appearance and the sizes for the exploitation during many years. However the inside exploitation defects type lamination arise there. The fibreglass that has these defects does not differ from the new material outwardly. Therefore, the analysis of the changes of the geometry dimensions of the cross-section of the fibreglass construction makes no sense.

The inside defects which can arise in the composition construction make worse its exploitation qualities and shorten the period of the work of the boat hull.

The period of the work of the fibreglass boat hull is determines with its stableness to the influence of the mechanical loading and of the water and of the heat and of the frost and of the ultra-violet rays of sunny light also the emergency loading. All this factors are the origin of the exploitation inside defects.

The state agencies estimate of the technical condition of the fibreglass boat hull by sight now.

The observation with the dynamics of the progress of the inside defects type the lamination in the composition boat hulls for the exploitation with the special testing methods allows to have the information about change of the technical condition of this hull for the all period of the work.

The special testing methods especially the non-destructive testing discovers the inside defects of the composition materials for example of the fibreglass boat hull on the different stages of its progress.

The acoustical testing methods discover the inside defects type the lamination in the different parts of the composition boat hull on the different depth.

The impedance and impact testing methods are used for the control of the composition boat hull. The portable flaw detector with the acoustic scanner and the impedance and impact reformers are used for that.

Some hundred inside defects type the lamination for the exploitation exist in the every boat hull by the control. The majority of the boats have not more 200 hours for the year or not more 1000 hours for the five year. The all this boat hull is unsatisfactory by the rules of Russian River Register.

Therefore, the rules of Russian River Register about the estimation of the technical condition of the composition boat hull for the exploitation are unnecessary hard. Therefore, it is being in need of the modern objective mode of the estimation of the technical condition of the composition boat hull that bases on the other criterions.

This mode of the estimation of the technical condition of the composition boat hull for the exploitation bases on the search of the inside defects in the boat's composition constructions by the impedance and impact testing methods and on the measuring of their parameters. Then the results correlate with the criterions of the strength and of the durability.

The estimation of the change of the strength with the inside defects type the lamination that arise for the exploitation is the criterion of the strength and of the durability for the composition boat hull for the exploitation.

The estimation of the change of its strength is the comparison of the strength of the construction which calculate by the norms of the project for the new boat hull and the strength of this construction which calculate with the presence of the inside defects type the lamination for the exploitation which have the definite size.

The two principal criterions are the change of the strength near the inside defect type the lamination and the size-limit of the inside defect attached to its rise can begin.

The size-limit of the inside defect type lamination in the composition construction fixes for the construction integrity for the all exploitation. In addition to the size-limit of the inside defect fixes for the construction strength and for its steadiness and for its durability.

The limit of the reduction of the construction strength determines the inside defect type the lamination if the stresses in the construction exceed the permissible limits attached to that.

The limit-size of the inside defect type the lamination determines of the conditions when the defect increases attached to the stresses that act in the construction.

The limits of the strength of the fibreglass attached to the tension and to the shear are the dangerous stresses. They decrease in accordance with the factors of the exploitation.

The all constructions of the boat hull offer as the three principal rated models:

- The absolute hard plate with two layers;
- The absolute hard plate with three layers and the middle light filer;
- The absolute hard plate with three layers and the middle stiff layer.

The macro-defects share from the micro-defects by the results of the flaw detection.

It arise by the means of the accumulation of the micro-defects on the front where the macro-defect forming.

The velocity of the accumulation of the micro-defects depends on the local stresses. The nature of the increase of the macro-defect depends on the distribution of the micro-defects in the environment of its front.

The micro-defects continue to accumulate on the front of the macro-defect when the load acts on the composition. Then the macro-defect increases by great advance again.

The weakening or the disappearance of the tie between the next layers in the zone of the defect relaxes the mechanical description of the construction.

This weakening can reach down to four times by the experiment.

The lowering of the mechanical description of the construction excites the increase of the stresses within the zone of defect.

The increase of the stresses above the appointed value give raises the further progress of the defect.

Then the size of defect is down to the values when it influences on the strength of the construction strongly.

So the macro-defect begin to influence on the redistribution of the stresses in the composition construction from the outward load when the defect reach the appointed sizes

The mode of the estimation of the technical condition of the composition boat hull for the exploitation with the control by the impedance and impact testing methods and next after that the measuring of the defect and the comparison it's value with the utmost dimensions has been patented.