The most important physical and technical properties of the developed material of composite sleepers of optimal composition, determining their long-term operation in the railway track, have better indicators than the material of the industrially developed composition: the value of the rate of linear thermal expansion is 1,6 times lower, and water absorption is 7,8 times lower; in this case, to establish the latter dependence, a new method for determining ultra-low water absorption for high-density materials was used, based on establishing a change in the volume of a sample upon its contact with water using electron-correlation speckle interferometry.

Contactless measurement of the deformation field by laser interferometry made it possible to establish the block nature of the destruction of samples of the material of composite sleepers under load, and using laser interferometry according to the developed method for assessing natural stresses, to show that the plastic nature of destruction of samples of optimal composition is due to a decrease in the level of natural stresses in it; Russian Federation patents No. 2672192 and No. 2710953 were received for devices for determining sample deformations during loading using a contactless laser interferometry method.

Technological schemes have been developed for extrusion (Russian Federation patent No. 2738498) and injection (Russian Federation patent No. 2737711) manufacturing of not only composite sleepers for various types of railway tracks, but also of bridge and switch beams, and of developed (Russian Federation patent No. 2707435 and People's Republic of China patent No. 20862218.6) innovative design of a composite sleeper reinforced with bamboo rods with adjustable load-bearing capacity and a reduced (up to 11 % of the maximum permissible) value of the rate of linear thermal expansion. The life cycle assessment of the composite sleeper confirms the competitiveness of the proposed composite sleeper design relative to wooden sleepers in terms of environmental sustainability.

2.1.5. Construction materials and products.

The work was performed and defended at Russian University of Transport. ●

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Compiled by Natalia Oleynik ●