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APPLICATION OF MATHEMATICAL MODELING OF IMPREGNATION DURING MANUFACTURE BY THE VARI INFUSION PROCESS OF RAILROAD FREIGHT CAR ROOF AND BODY FROM COMPOSITE MATERIALS ..... 65

Composite structural elements are often produced by resin vacuum assisted impregnation of reinforcing fibres by vacuum. Designing the infusion process means developing a configuration of the impregnation system. The present paper describes an authors' experience in mathematical modeling of impregnation by vacuum infusion applied to large structures of roof and body of a hopper car made of composite materials. Some examples of impregnation system selection are presented (p. 65-83; fig. 21).

**I.S.Deev, L.P.Kobets, A.F.Rumyantsev**

A STUDY OF THE FRACTURE SURFACE OF CARBON FIBER REINFORCED EPOXY BINDER AFTER MEASUREING FRACTURE TOUGHNESS (MODE II) ..... 84

Scanning electron microscopy of fracture surfaces of the carbon fiber reinforced polymers (CFRP) after measuring fracture toughness (mode II). It is shown that delaminating epoxy of CFRP is accompanied by plastic deformation of microphase structure of polymeric matrix as well as formation of torsions and hyperbolic microcracks in it. A variety of the types of fracture is a consequence of long-time loading. It is revealed that plastic deformation of microphase structure of matrix is larger in the fracture zones in which the delamination rate is smaller. The hypothesis on heterophase structure of epoxy matrixes formulated earlier is confirmed. The polymer is actually a media composed molecular and dispersive of high viscosity fluid, in which nanoparticles are moving and deforming being under stresses (p. 84-94; fig. 10).

**V.S.Zarubin, G.N.Kuvyrkin, I.Y.Savelyeva**

AN EFFECT OF THE FORM OF LAMELLAR INCLUSIONS ON THE EFFECTIVE THERMAL CONDUCTIVITY OF A COMPOSITE ..... 95

A quantitative analysis of effect of deviations from an ideal form of directionally oriented lamellar inclusions on the effective thermal conductivity of a composite is carried out. The ideal form of the inclusions is assumed as thin circular disks; the deviations from which correspond to the ellipsoid with an arbitrary ratio of the semi-principal axes. In the calculations, reference values of the parameters are assumed to correspond to the values are expected to be observed in composites with graphene inclusions.

A bilateral evaluation of the effective coefficients of thermal conductivity made by using a dual formulation of the variation problem of stationary heat conduction in a non-homogeneous body confirms an adequacy of the model used in the analysis of the thermal interaction between the inclusions and matrix (p. 95-104; fig. 2).

**A.T.Volochko, A.A.Shegidevich, D.V.Kuis**

FORMATION OF STRUCTURE AND PROPERTIES OF COMPOSITES OBTAINED BY INTRODUCING IN ALUMINUM MELT LIGATURES CONTAINING GLASS-LIKE CARBON PARTICLES ..... 105

Introducing in alloys aluminum composites by ligatures containing particles of amorphous glass-like carbon phase improves the structure of base alloys and increases their plastic, strength and tribology properties. It is shown that formation of particles of amorphous glass-like carbon phase in ligature is possible provided nanostructured carbon in the form of fullerenes and fullerene blacks is used. No difference in the composite structure obtained by using expensive fullerenes and their cheap substitutes is found. The structure of composites is characterized by a high dispersity and homogeneity;  $\alpha$ -phase dendrites are hardly discernable. The alloy structure change increases wear resistance by a factor exceeding 5 (p. 105-116; fig. 10).

**A.I.Samatadze, I.V.Parahin, N.F.Porosova, A.S.Tumanov**

A CHOICE OF THE PLASTICIZER FOR PHENOLIC-RUBBER FOAM ..... 117

An effect of different types of the plasticizers on technological and working properties the phenol-rubber foam is studied. It is shown that adding 3-5 weight percent of a particular type of the plasticizers a phenol-rubber mixture yields a shrinkless elastic polymer foam (p. 117-124; fig. 6).