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Research of thermomechanical properties of polymer composite materials

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Abstract: the main content of this article is provided for the creation and application of flame retardant polymer composites to protect structures from thermal impact from Industrial Safety, large-scale scientific research work on the formation of Coke under the influence of thermal temperature, technology to protect compounds from its development, to increase thermal and corrosion tolerance of structures.
Keywords: corrosion, heat and corrosion of metal structures, iron and steel products, temperature, coatings.

Introduction. The dimensions of the cross-sections of structures are determined by calculating their resistance to load-bearing, deformation and cracked departure. Construction structures are designed taking into account the operational, technical economic, elastic and other requirements for them.

According to operational requirements, it is necessary to ensure that any construction is suitable for whatever purpose it is intended, and that the technological processes being carried out in a building or structure are convenient and safe.

ANALYZES AND RESULTS. Technical requirements consist in ensuring that the necessary strength of the structures is biased and long-lasting. Important requirements for construction structures include the industriality of their preparation and the bop of technology. Prefabricated structures consisting of factory-made elements fully satisfy these requirements. Economic requirements greatly affect the choice of structural material, their calm (for example, the height of the fence).The purpose of calculating construction structures is to create, structures with sufficient lifting capacity to total loads that are externally exposed by spending a small amount of material. Metal structures are calculated mainly by boundary States. Marginal cases are understood to mean that constructions fail to meet predetermined requirements in the process of use. The first group of boundary States is associated with a loss of load-bearing capacity of the

structure, and they include: loss of general ustability of the form, loss of situational ustability, exhaustion of the metal of the device, or any other characteristic violation, violation as a result of the joint unfavorable influence of loads and the external environment, resonant fluctuations leading to, situations where constructs cannot be used as a result of spontaneous stretching or excessive opening of the darts.

The second group of boundary States is due to the fact that the normal use of the construction has become more difficult, and they include: situations that lead to a decrease in the duration of operation as a result of the appearance of impenetrable shifts, vibrations and darts. It consists in calculating constructions to boundary States and ensuring that none of the boundary States occurs at all stages of the construction or use of the structure.

The general condition for the first group boundary states can be written as: $N \le S$

N - the force generated by the unfavorable joint effect of loads on the element being calculated,

S - the load-bearing capacity of the element being calculated.

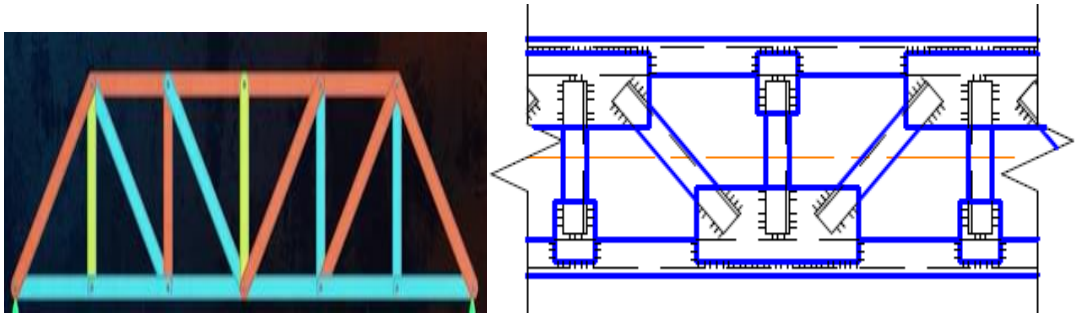

Figure 1 metal structures

The resulting force on an element is determined by the following formula:

$$N = \sum_{i=1} F_{ni} \cdot \overline{N_i} \cdot \gamma_{fi} \cdot \gamma_n \cdot \psi \quad \textbf{(1)}$$

Here

- $\overline{N_i}$ power $F_{ni} = 1$ the force generated on an element equal to;

γ_{fi} – reliability coefficient by load;

γ_n – reliability coefficient according to the function of the building;

ψ - coefficient that takes into account the joint effect of loads.

The load-bearing capacity of an element depends on its surface and the resistance of the material, which is determined as follows:

$$S = A_n \cdot R_{up} / \gamma_m \cdot \gamma_s = A_n \cdot R_y \cdot \gamma_s \quad \textbf{(2)}$$

Here:

A_n – netto surface of the cross section of the element;

R_y - computational resistance to Element material fluidity;

γ_s – coefficient taking into account the operating conditions.

Thus the computational equation for the boundary state of the first group is written as:

$$\sum F_{ni} \cdot \overline{N} \cdot \gamma_{fi} \cdot \gamma_n \cdot \psi \leq A_n \cdot R_y \cdot \gamma_c \quad (3)$$

The second group calculus expression for the boundary case can be written as:

$$\sum F_{ni} \cdot \overline{N_i} \cdot \gamma_n \cdot \psi \cdot \overline{\delta_2} \cdot \leq \delta_2 \quad (4)$$

here:

- $\overline{\delta_2}$ - elastic displacement generated in the element under the action of a unit load;

δ_2 - the marginal displacement of the norm-fixed construction is.

Experiment 1: when most materials are heated or cooled, their thermomechanical properties change. For example, against the background of thermal expansion, phase transitions, sintering or softening may occur.

Thermomechanical analysis (TMA) determines the volume and volume change of solids, liquids or adhesive materials as a function of temperature and time when a particular mechanical load is applied (standards DIN 51 005, ASTM E831, ASTM D696, ASTM D3386, ISO 11359). This method is close to the dilatometry method, and changes in the dimensions of solids or liquids are measured under light load (e.g., DIN 51 045).

Also, in the study of the thermal properties of a sample based on epoxy Mercury obtained during practical experiments, a thermomechanical method was applied to the surface of the sample by a certain constant force mass.Based on the norms established in this case (ISO 11359), the temperature was increased in parallel with the constant force exerted on the surface.

Thermomechanical and thermophysical research analyzes of the resulting naamunas were synthesized at the Tashkent chemical and technology research base and the results of

thermomechanical analysis of samples were presented.

Figure 2. Thermomechanical analyzer INV-17

The surface of the sample obtained for the experiment and the strength calculation given to the sample were determined using the appropriate formulas. The thermomechanical property of the resulting sample is to study its surface 153mk m^2 the fact that the sample is under a constant force of 27 N, to the sample 0.176 M N/m^2 test experimental work was carried out when the weight force was affected and in the range from +1oC temperature to +350^{o}Ctemperature using a special pribor.

Listed below (Figure 2). a thermomechanical curve of the sample is given. The captured sample is heated to a temperature of 350°C under the influence of a constant weight force of 0.176 m n/m^2.

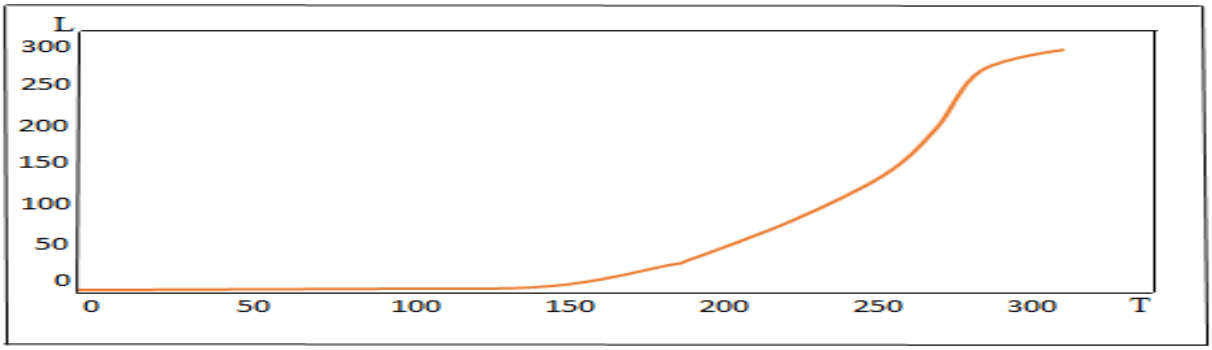

Figure 3 thermomechanical curve of a sample based on epoxy simulation

T-temperature, °C; l-deformation inversion mm;

Thermomechanical curve deformation is observed without constant change of the sample to a temperature of 45^0C, softening inversion of the sample deformation is observed in the temperature range of 60-150°C. Continuing to increase the temperature leads to the transition of the sample to a high elastic state. This process was observed to a temperature of 350°C. The temperature and

deformation change intervals are listed in Table 1.**Harorat va deformasiyaning o‘zgarish intervallari**

№	**Temperature**	**Deformasia**
1	0^0C - 45^0C	0 mm – 1 mm
2	45^0C - 100^0C	1 mm – 1,5 mm
3	100^0C - 150^0C	1,5 mm – 2 mm
4	150^0C - 200^0C	2 mm – 50 mm
5	200^0C - 250^0C	50 mm –100 mm
6	250^0C - 295^0C	100 mm –250 mm
7	295^0C - 350^0C	250 mm – 300 mm

In the temperature range from 00s to 45^0C, a change in deformation from 0 mm to 1 mm was observed. The deformation force at temperature 45-100^0C is 1 mm – 1.5 mm. Softening inversion of sample deformation is observed in the range of 1.5 mm - 2mm at temperature 100 – 150^0C analysis shows that the transition of sample to high elastic state at temperature 295 - 350^0C leads to deformation strength of 300 mm. At critical temperature 350^0C, the sample deformation was observed to peak unchanged inversion at 250 mm-300 mm.

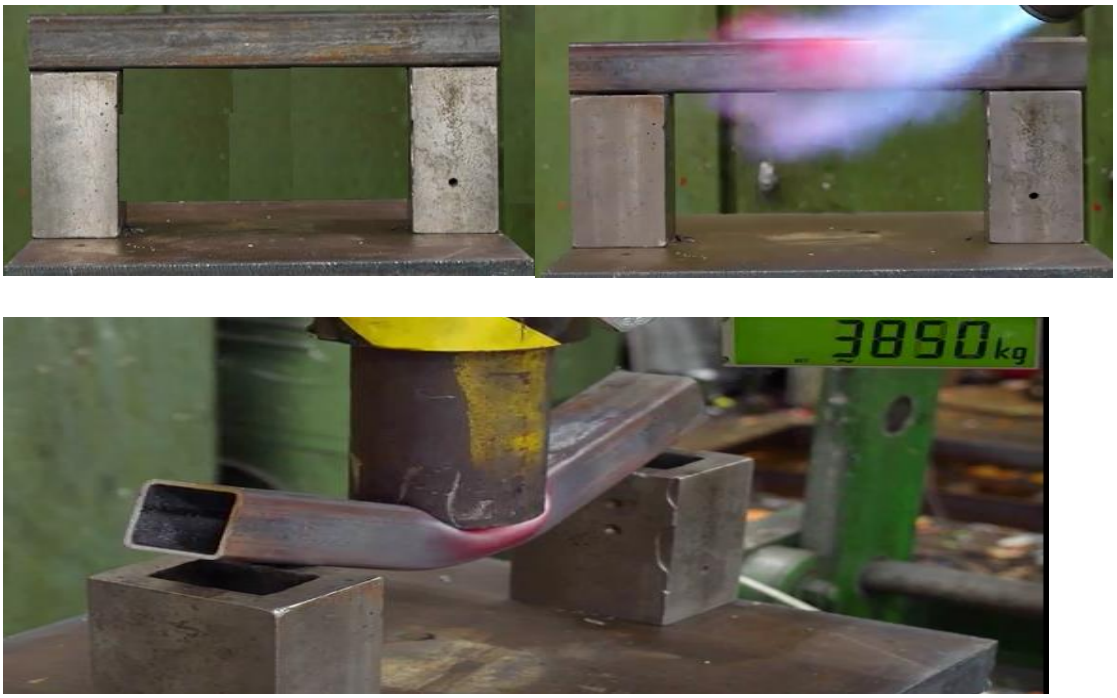

Figure 4 when materials are heated

Experience 2

In the course of practical experiments, in the study of the thermal properties of samples obtained on the basis of epoxy simulation, a thermomechanical method was applied to the surface

of the sample by a certain constant mass of fly. Based on the norms established in this case (ISO 11359), the temperature was increased in parallel with the constant force exerted on the surface.

Figure 1 below shows the thermomechanical curve of the sample. The obtained sample is heated to a temperature of 350°C under a constant force of 21n(Figure **1).**

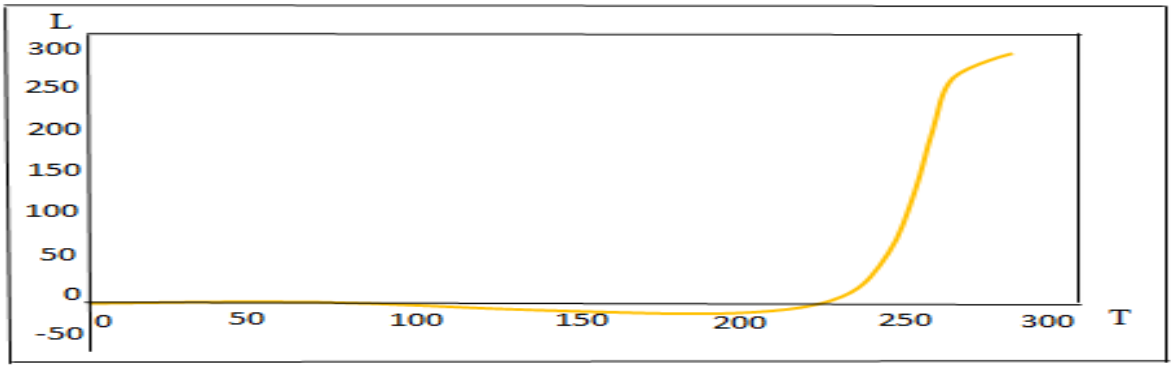

Figure 5. thermomechanical curve of the sample:
T-temperature, °c; l-deformation inversion mm;

Thermomechanical curve the deformation of the sample to a temperature of 55^0C is observed without constant change, the temperature is observed in the range of 75-285°C, the swelling (annealing) inversion of the sample deformation. Continuing to increase the temperature leads to the transition of the sample to a high elastic softening state. This process was observed to a temperature of 350°C. The temperature and deformation change intervals are listed in Table 1.Table 1.The temperature and deformation change intervals are given.

№	**Temperature**	**Deformasia**
1	0^0C - 55^0C	0 mm – 0 mm
2	55^0C - 100^0C	0 mm – (-1) mm
3	100^0C - 150^0C	(-1) mm –(-15) mm
4	150^0C - 200^0C	(-15) mm –(-25) mm
5	200^0C - 225^0C	(-25) mm –0 mm
6	250^0C - 350^0C	0 mm -380 mm

The surface of the sample taken for thermomechanical analysis will be equal to 177mk m^2 when the weight force of 0.12 m n/M^2 is affected by the sample temperature in the range from 00c to 55^0C deformation in 0 mm has been observed. At temperature 55-100^0C, the deformation force is 0 mm – (-1) mm. At temperature 100 - 150^0C (-1) mm – (-15) mm swelling (annealing) observed analysis shows that at 200 - 350^0C the transfer of the sample to a highly elastic state results in a deformation force of 0– 380 mm. Finally in the temperature range of 350^0C, the highest inversion of the sample deformation at 380 mm was observed.

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