"Nanocomposites and nanomaterials"

Heat-resistant compositional materials based on difenilolsulfonformaldehyde oligomer and silicon oxide

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The machine building industry of Ukraine is in urgent need of new heat-resistant polymeric compositional materials for manufacturing the machines and mechanisms operating at high levels of temperature and loads. The particular focus should be attended to a problem of creation of those composites with the maximum use by the national raw materials base.

For the solution of a number of applied tasks it is important not only the establishment of technologies production and optimization of physical-mechanical properties of new composite materials, but also but also to develop a method of synthesis of advanced polymer matrices with high strength and thermal stability.

The new method of synthesis of phenolic resins – difenilolsulfonformaldehyde oligomers had been developed, and also a new method of production polymeric compositional materials based on such phenolic resins had been obtained. These materials contain to 80% of filler – nanoscale silicon oxide (produced in Kalush city of Ukraine). This filler has wide spread surface (to 120 m^2/gr) and active "silanol" groups which are capable to chemical and physical interaction with a phenolic resin matrix together with their processing into the product.

The thermal and physical-mechanical analyzes of these composite materials based on the content in their composition of silicon dioxide are shown in the following table.

Physical-mechanical and thermophysical properties of developed polymeric compositional materials

Measure	The filler concentration in polymer, %				
	0	20	40	60	80
Temperature of the beginning of active destruction T_1, ^oC	340	344	353	360	372
Compressive stress at yield point σ_y, МПа	185	192	198	150	121
Hardness H, МПа	132	150	152	128	116

It was established that the allotment of silicon oxide in difenilolsulfonformaldehyde oligomer results to increasing of thermal stability level and physical-mechanical properties of obtaining polymeric compositional materials. Its thermal stability rises on 15-20^{o}C. The compressive stress at yield point increases to 198 MPa and hardness to 152 MPa in composites with 40% of silicon oxides.

Hence, we can conclude that the composites based difenilolsulfonformaldehyde oligomer and nanoscale silica are perspective materials for production of machines and mechanisms operating at high load levels up to 190 MPa and temperatures up to 350^{o}C.