Инновационное производство композитов: от строительной армatury до модулей электробуса

Innovative production of composites: from rebar to electric bus modules


Д. Георгиев / printcomrussia@mail.ru

In September-October, the first in Russia all-composite electric bus created by the Nanotechnology Centre of Composites (NCC) and the Hungarian Evopro Group was tested on the streets of Moscow. The Russian participant of the joint project produces a self-supporting modular fiberglass body, the use of which has allowed to significantly reduce the mass of the vehicle. Production of body parts and other products made of composite materials was demonstrated to journalists during a press tour organized by the NCC in conjunction with the FIEP RUSNANO.

ЦК – производственно-инженерный центр, созданный в 2012 году холдингом "Композит" и Фондом инфраструктурных и образовательных программ РОСНАНО. В 2014 году в число учредителей вошла компания DowAksa Advanced Composites Holdings – совместное предприятие Dow Chemical (США) и Aksa (Турция).

В настоящее время НЦК располагает производством площадью 15 тыс. м², где эксплуатируется более 40 технологических машин и линий. Предприятие располагает современными лабораториями с 60 единицами измерительной техники. В общей сложности в оборудование было инвестировано около 25 млн евро. В штате НЦК работают более 200 специалистов, решающих широкий круг задач в области разработки и производства продукции из композиционных материалов.

Компетенции

Компетенции НЦК включают разработку концепции, НИР, ОКР, опытно-технологические работы, изготовление оснастки, опытное производство, лабораторные и сертификационные испытания (функциональные, климатические, механические, температурные и специальные), а также промышленное производство.

В производстве используются автоклавное формование, напыление, инъекция, инъекция (Resin Transfer Moulding, RTM), литье под низким давлением (Reaction Injection Molding, RIM), инъекция длинного волокна (Long Fiber Injection, LFI), прессование препрегов/премиксов (SMC/BMC), пултрузия, намотка, термоформовка, литье под давлением. В цехе механообработки выполняются отрезные операции, токарно-фрезерная обработка, сварка, гидроабразивная резка, лакокрасочные работы.

Например, важным направлением является изготовление изделий из стеклопластика и углепластика по технологии вакуумной инъекции (напыления, контактного формования, RTM и пр.). Дешевизна технологической оснастки и хорошие механические свойства материалов позволяют получить качественные, недорогие и долговечные изделия даже при изготовлении единичной продукции. В частности, НЦК успешно реализовал несколько десятков проектов по изготовлению методом вакуумной инъекции...
CC is an industrial and engineering center created in 2012 by the Composite holding company and the Fund for Infrastructure and Educational Programs of RUSNANO. In 2014, DowAksa Advanced Composites Holdings, a joint venture of Dow Chemical (USA) and Aksa (Turkey), became one of the owners.

Currently, NCC has a production area of 15 thousand sq.m, where more than 40 technological machines and lines are operated. The enterprise has modern laboratories with 60 units of measuring equipment. In total, about 25 million euros were invested in the equipment. NCC employs more than 200 specialists who solve a wide range of problems in the development and manufacturing of products made of composite materials.

COMPETENCIES

The competencies of the NCC includes the development of a concept, R&D, experimental and technological work, the manufacture of machining attachments, pilot production, laboratory and certification tests (functional, climatic, mechanical, temperature and special) and industrial production.

Autoclave molding, spraying, infusion, Resin Transfer Molding (RTM), Reaction Injection Molding (RIM), long fiber injection (LFI), SMC/BMC, pultrusion, winding, thermoforming, injection molding are used in production. In the machining department, cutting operations, turning and milling, welding, hydroabrasive cutting, and varnish-and-paint operations are performed.

For example, an important area is the manufacture of products made of fiberglass and CFRP using vacuum infusion technology (spraying, contact forming, RTM, etc.). The cheapness of technological equipment and good mechanical properties of materials make it possible to obtain high-quality, inexpensive and durable products even in the manufacture of single batches. In particular, NCC successfully implemented several dozens of projects for the production of various types of caps, casings, fairings, spoilers, bumpers, panels, wings by the method of vacuum infusion.

The center has injection molding equipment, which provides a clamping force of up to 1150 tonnes and a maximum injection mass of up to 3 kg. It is possible to produce complex parts using two materials. Products have a perfectly flat surface without shells and foreign inclusions at 5-12 grade accuracy of geometric dimensions. The production capacity of the injection molding section reaches 50 thousand items per day.

Using the method of thermo-vacuum forming of plastics, the NCC produces the elements of the casings for production equipment, medical and household appliances, as well as details of the interior and exterior of the cabins (panels, lining, covers, covers) and much more.

When developing new products of polymer composite materials (PCM), the consolidation, analysis and coordination of requirements, selection of materials, selection or development of manufacturing technology, carrying out laboratory and acceptance tests are carried out.

One of the important activities of the NCC as a participant in the
network of nanotechnology centers is
the launching of startups in the area
of PCM technologies.

PROJECTS AND PRODUCTS
The assets of NCC include more
than 100 completed projects,
20 product patents and about
30 commercially successful product
types. The Nanocenter successfully
performs R&Ds for implementation
of PCM in the projects of the larg-
est companies, including Rosatom,
RZD, Gazprom and RusHydro.
About 30% of the products are
exported to other countries.

The center’s own products are
the Carbon Wrap system based on
carbon fiber for reinforcing concrete
structures, the Monsterprofile fiber-
glass profiles, Monsterprofile fence
rails, composite drainage channels,
Monsterod fittings, temporary road
slabs, composite products for road
infrastructure improvement (paving
slabs, delineators, ramp, support of
the road sign stand), fiber for rein-
forcement of concrete and asphalt
concrete, supports of the contact
network, composite supports of
overhead power lines.

Composite products provide
users with numerous advantages.
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with numerous advantages. For
example, the use of the Carbon
Wrap to reinforce concrete struc-
tures allows repair without stop-
ping production or traffic, reduc-
ing repair costs, increasing the
overhaul period, making it possible
to correct design and construction
errors without weighting the origi-
nal structure.

Fiberglass Monsterprofile is char-
acterized by low weight, corrosion
resistance and durability. Different
color solutions and different profiles
are available.

Composite drainage channels
are used in industrial and civil con-
struction. NCC develops and manu-
factures drainage channels for any
size and load. The use of PCM allows
to reduce the time of installation of channels, to increase the period of their operation and to exclude expenses for maintenance.

NCC produces three types of rebar: glass-composite, basalt-composite and carbon-composite. Composite rebar has high strength, low weight, is not susceptible to corrosion, resistant to acids and sea water, radio transparent, magnetically inert and durable in concrete environment.

Slabs for the construction of temporary roads allow rapid construction in difficult-to-reach areas of roads that are suitable for the movement and operation of heavy equipment and do not require maintenance. The use of composite slabs makes it possible to exclude the costs of preparing the base of the road, reduce the time of its installation by three times, and the labor costs by eleven times. Composite slabs have been successfully tested and used in the oil and gas sector and in construction.

For the improvement of road and urban infrastructure facilities, paving slabs, delineators, ramps, pillars of road signs are manufactured. These types of composite products are easy to install, safe, resistant to shock loads and not prone to frost.

Tactile floor indicators produced by the NCC are bright yellow tiles with various patterns, designed to facilitate the orientation of persons with poor eyesight and limited physical abilities. Tactile indicators are characterized by high wear resistance, resistance to road reagents, resistance to temperature changes, low weight and thickness, and color stability (colored in mass).

Another type of products for the construction industry is fiber for the reinforcement of concrete and asphalt concrete. Fiber has a high adhesion to the cement matrix, is not susceptible to corrosion, provides increased frost and crack resistance. The use of fiber makes it possible to reduce the amount of cement, increase the frost resistance of concrete, and reduce the loss of fresh concrete.
resistance, and also prevents the unmixing of the concrete.

Composite supports for maintaining the conductors of the contact network at a certain height and in the desired position relative to the road make it possible to avoid using insulators due to the dielectric properties of fiberglass. Reducing the weight of the supports simplifies installation, and the corrosion resistance of the composite increases their durability.

Also, the NCC produces supports for overhead power lines. The use of composite materials significantly reduces the weight of structures, which leads to a reduction in the cost of construction and installation works and transportation, and also increases the service life of supports and reduces operating costs.

**UNIQUE ELECTRIC BUS**

In 2016, the NCC was awarded the Innovation Awards in the Urban Transportation category at the international exhibition JEC World 2016 in Paris for a unique solution in the creation of a self-supporting composite body for the MODULO C68E electric bus.

Serial production of electric buses is organized by NCC together with the Hungarian holding company Evopro Group. The use of PCM provides for reducing the weight of the bus by several tons and reducing its size by 2-3 meters. The latter increases the maneuverability of the electric bus, allowing it to travel on routes that are inaccessible to vehicles with a large turning radius. Reducing the weight of the body not only improves the economy and reduces the cost of the electric bus, but also reduces the load on the suspension and road surface. At the same time, due to the efficient design, MODULO accommodates more passengers compared to buses of the same length.

The production range of the joint venture of NCC and Evopro Group...
includes models with a capacity of 40 to 90 passengers with a body length from 6.5 to 9.5 meters, which can be equipped with various engines. In particular, the MODULO buses are equipped with 160 kW electric motors and a SIEMENS control system.

There are various options for integrating electric public transport into urban infrastructure. For example, electric buses with a 4 hours night charge and a cruising range of more than 200 km, machines with charging from a trolleybus contact network, and also charging with a pantograph were developed. The use of such solutions reduces the amount of investment in the reorganization of the infrastructure of the urban transport network.

According to Evopro Holding, since 2016 several dozen MODULO buses have been used in the city transport of Budapest, showing one of the lowest energy consumption in the world.

In Moscow the model MODULO C68E of medium capacity was successfully tested, which for a week passed through the streets of the city more than a thousand kilometers. Tests showed that to ensure the whole day of work of the electric bus, one night charge of three hours duration is sufficient.