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PROSPECTS OF USING COMPOSITE MATERIALS IN OIL AND GAS INDUSTRY

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In the world practice, composite materials are widely used in the oil and gas industry. In particular, fiberglass is used for production of field pipelines and reservoirs for storage of hydrocarbons, but this material has not been widely used in the Republic of Belarus, which raises questions, since glass-reinforced plastic (GRP) has a number of advantages compared to the metal of which the equipment is manufactured at present.

Composite material (composite, CM) is a structural (metallic or non-metallic) material which contains reinforcing elements in the form of threads, fibers or flakes of a more durable material. Examples of composite materials are plastics reinforced with boron, carbon, glass fibers, tows or fabrics based on them; aluminum, reinforced with steel and beryllium threads. By combining the volume content of the components, composite materials can be produced with the required strength, resistance to high temperatures and fire, modulus of elasticity, abrasion resistance, and also to create compositions with the necessary magnetic, dielectric, radio-absorbing and other special properties. By structure, composites are divided into several main groups: fibrous, laminated, dispersed, reinforced with particles, nanocomposites.

If we take a look at the oil and gas equipment used in manufacturing today, the main manufacturing material is steel. Steel is used for technical applications in mining, servicing, well overhaul, transportation and storage of raw materials. However, steel has a significant drawback, that is, a susceptibility to corrosion, due to both external exposure to the natural corrosive environment, and the chemical effect on the inside. Another significant drawback is the considerable weight of the equipment, which complicates the installation work and leads to the increase in cost, as well as the increase in transportation costs. In addition, using steel equipment leads to significant heat losses, which results in large energy costs to maintain the minimum temperature of the equipment. And it is typical for oil field equipment to operate in difficult operating conditions, especially for built-in equipment. Thus, for example, the operating time without failures of an electrical submersible pump unit depends on many factors. These include the angle of curvature of wells, intensity of curvature, presence of sharp bends of the trunk, composition of pumped liquid, pump descent depth, vibration impact, manufacturing technology, etc.

The solution of these problems is the usage of composite materials (fiberglass, reinforced thermoplastic). At present, in the oil and gas industry, the use of fiberglass pipes is widely developed, which are four times lighter than steel pipes with equal strength. They are not susceptible to corrosion, are resistant to chemicals, have a non-built-up smooth internal surface, which allows the use of pipes of smaller diameter in pipelines. They have low flammability, increased physical and mechanical properties, strength and resistance to overload. Fiberglass pipes are suitable for transportation of various liquids, gases, bulk materials, and can be used for drainage devices. Pipes are resistant to oil products, gas condensate, acids and alkalis. They do not require electrical protection against stray currents and are easy to install. One of the popular usages of composites is the production of vessels and tanks which are used in large quantities in oil production and storage of petroleum products.

Despite the obvious advantages of composite materials, in particular, fiberglass, it has not received wide application in the Republic of Belarus. One of the main reasons for that is the lack of an appropriate regulatory framework, because the production, use and maintenance of composite materials and structures made of them is regulated by technical standards (TNPA).

There are examples of current technical standards for products, which are made of fiberglass:

- Europe:

EN 13121-3-2016. GRP tanks and vessels for use above ground. Part 3: Design and workmanship;

- Russia:

GOST R 54559-2011. Pipes and parts of pipelines made of thermoset fibers reinforced with fiber. Terms and definitions;

GOST R 54560- 2011. Pipes and parts of pipelines made of fiberglass reinforced thermosets. - Specifications;

GOST R 54924, GOST R 54925, GOST R 54926, GOST R 55069, GOST R 55070, GOST R 55071, GOST R 55875, GOST R 55876 - Test methods;

GOST R 55072-2012. Tanks made of thermosetting fiber reinforced with glass.

- Belarus:

GOST 33123-2014. Pipes made of polymeric composites. Technical conditions - International standard; GOST 6943.3-79, GOST 6943.6-79, GOST 6943.8-79, GOST 6943.10-79, etc. Soviet GOSTs - Quality control of products.

The Republic of Belarus has a good background for the developing the market of fiberglass products (e.g., highly skilled workers, OJSC Polotsk-Steklovolokno). So, we need to develop a regulatory framework for the design and operation of structures made of composite materials, based on the international experience, as well as exploring the foreign technical standards.

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