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Solving Problems of Prevention of Technogenic Catastrophes in Construction

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Abstract

In 150-year anniversary 2019 is announced international year of a periodic system of elements of the great domestic scientist-chemist D.I. Mendeleyev, and 70 years ago in Moscow the era the global chemicalixation in construction" began ". The metro bridge in Moscow on Sparrow Hills (1958-2002) and a monument the Motherland in Volgograd (1967-2019) is presented by the longest and most expensive 50 years' repairs in the history of domestic construction. In article one of the most current problems of XX1 of a century is considered: construction of durable and reliable bridges from all-weather Concrete which is not subject to corrosion and maintains repeated overloads can be operated in the wide range of gradients of temperatures. The super and durable, safe, reliable, simple, economic technology of a nanocomposite of the future which was developed, investigated, checked in Moscow more than 30 years ago is considered, and products and designs from a new nanocomposite within more than three decades are checked in various constructions at temperatures from plus 50 to minus 50 degrees Celsius.

Keywords: Nanocomposite; Bridge; Durability; Reliability; Protection against corrosion; Welding shops; Ecology; Basalt nano fibre; Carbonic fiber; Climate; All-weather capability; Frost resistance; Profitability; Availability; Power - and Resource-saving

Introduction

2019 is stated international year of the Periodic table of chemical elements, so the world scientific community will celebrate the 150 anniversary of opening of the Periodic law of chemical elements by the great Russian scientist D.I.Mendeleyev in 1869. Over the past hundred and a half years, the achievements of domestic chemists have been successfully applied in various industries in Russia, students of D.I.Mendeleev (1834-1907): academician P.A.Rehbinder (1898-1972), professors V.N.Yung (1882-1956) and B.D.Trinker (1914-2004) have created materials and technologies that are used in the World in XX1.

All know about the recent accident of the bridge in the Italian Genoa (a 210 metres (690 ft) section of the viaduct collapsed during a rainstorm on August 14, 2018, 43 people died) which resulted from engineering mistakes at the design and lack of scheduled preventive inspection and repair which led to corrosion of concrete and fittings and death of dozens of people, and according to the WDR program (Westdeutscher Rundfunk, Germany) in a month after accident showed the report about "Carbonbeton" - allegedly "new" material which was developed and tested at the German university of the city of Aachen in 2015-2016, and now they recommend to build of this material all bridges around the world as it is stronger than usual concrete and is not subject to corrosion.

Experimental Details

However, in 1984-1985 best new Nano-Komposit of more reliable and most plain natural durable (!) domestic material was made by the author of article and successfully applied in large industrial volumes at several plants: Concrete goods No. 17 of Glavmospromstroymaterialy and Krasnopresnensky ZhBK DSK-1 of Glavmosstroy of Mosstroykomitet. Practical results and all production tests in 1985 were magnificent.

So, more than 35 years ago the chief technologist Mosstroykomitet Alexander Trinker made a new nanocomposite having applied only domestic available, simple and durable components, having outstripped foreign science. Since 1979 the author of article carried out search works [1,2] on replacement of steel fittings in concrete goods at the concrete goods enterprises of the Ministry of Energy of the USSR and Mosstroykomitet, for the purpose of increase in the main characteristics of products and reduction of welding shops for improvement of ecology of regions of the country. Let's remind: in the Mosstroykomitet system more than 120

plants and concrete goods plants of Moscow and area entered, besides there were hundreds of the concrete goods plants in the systems of the ministries: Ministry of Energy, Minmontazhspetsstroy, Minsredmash, Minpromstroy, Mintrasstroy, Minselstroy..... The composite of more reliable and most plain natural durable (!) domestic material was made by the author of article and successfully applied in large industrial volumes at several plants: Concrete goods No. 17 of Glavmospromstroymaterialy and Krasnopresnensky ZhBK DSK-1 of Glavmosstroy of Mosstroykomitet. Practical results and all production tests in 1985 were magnificent. The effective perspective preliminary solution was found after studying of literature on a research and application of a fibrobeton with a steel fiber, however long tests for durability showed that the steel fiber [3-5] quickly corrosion, collapses.

Production Results

"Without fight there is no victory" – results of a 55-year research and production personal labor of the author [6], this motto became a guiding star that as a result of long search and comparative tests, led to universal all-weather domestic construction material suitable for application in the form of fiber. In 1985 the nano-composite technology with use of basalt fiber was successfully and is productively introduced by the author at the concrete goods Plant No. 17 (plant manager B.A.Bromberg) Spetsstroybeton of Glavmospromstroymaterialy Mosstroykomitet. Industrially more than 1000 pieces of drive combined piles from 7 to 17 meters long (Figure 1), the majority of which was sent to Tyumen (Siberia) and also at the concrete goods Krasnopresnensky plant (plant manager G.D.Uzdin) of DSK No. 1 of Glavmosstroy of Mosstroykomitet at production of three-layer external wall panels with flexible communications, plates of a roof, overlappings, crossing points, floorings, etc., in number of more than 1000 pieces (Figure 2) some of which sent for the Siberian buildings, are made. Metal served in all listed designs only for production assembly the slings of loops, welding was not necessary, the labor input on posts decreased, energy consumption, the only innovation on BSU decreased: separate container for fiber, transport giving and the batcher, that is resulted production modernization. For preparation of concrete mix standard micron fiber from basalt was applied to heat-insulating materials which was made on standard (!) technology on P.O. of Mosasbotermoglass in the city Railway the Moscow region, that is fiber was received in the shop of finished goods of P.O. Unique of technology that the product which is not specially made for tests in concrete, and long ago the material, known and ready to the use, – basalt fiber, decades having certificates of quality and permission of public health services was applied in the form of fiber. Except that basalt frost-resistant all-weather material, its thermoprotective properties (at high temperature) were confirmed within decades of production industrial application for thermal insulation of factory furnaces. More than 35 years of successful and accident-free operation of all listed products which expired since then confirmed durability in the conditions of frosty sharp and continental climate of Russia with frequent temperature differences through zero degrees Celsius, and very high prospects of new construction ecological nanomaterial. The economic profit of replacement of reinforced concrete by new composite nanotechnology was 35% - 60% of the cost of the products executed on traditional old technologies as welding works are completely cancelled, liquidate the harmful welding shops of the plants polluting the environment are modernized production of BSU.

Figure 1: Combined drive piles 17 meters long the Glavmospromstroymaterialy made on new composite nanotechnology at the concrete goods plant No. 17 (Spetsstroybeton), 1985. Author of unique ecological nanotechnology of concrete goods Alexander Trinker.

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Figure 2: The external wall panels manufactured on new composite nanotechnology at the DSK No. 1 concrete goods Krasnopresnensky plant of Glavmosstroy, 1985. Author of unique ecological nanotechnology of concrete goods chief technologist Alexander Trinker.

It should be noted that the basalt source of raw materials in Russia is huge and makes more than 3.5 - 4.5 billion cubic meters. Explored reserves of basalt do not leave doubt in prospects of use of natural basalt, unique and universal domestic construction material of the future which is at the same time a profitable product of export of Russia. Except tested decades ideal fire - heat-shieldings, heat insulations applicable in a mineral wool for industrial furnaces, basalt successfully replaces all products with steel fittings. For example for drive piles the requirement of high shock durability and viscosity is fulfilled. Concrete products from basalt fiber on composite nanotechnology have on orders higher rates on: abradability and wear resistances (road), durability (bridges and tunnels), the shock durability (the runway of airfields), durability on stretching at a bend (a cover of reactors of the NPP), cavitational firmness (dams and conduits of hydroelectric power station), corrosion resistance (monolithic covers of cooling towers, granulation tower, television towers), that is are suitable for all concrete goods complex of Industrial and Civil Engineering. As a result of full-scale implementation of composite nanotechnology several production problems, main of which will be at the same time solved: upgrade of the domestic construction industry, expenses will also be reduced, terms of accident-free operation of buildings and constructions as products on composite nanotechnology from basalt nanofibre several times more long-lasting, frost-resistant and are abraded - resistant considerably are several times prolonged. More thirty years' experience of development, implementation and operation of composite ecological nanotechnology from basalt in Moscow allows to draw a conclusion: basalt as construction material went beyond walls of laboratories and questions of its full-scale production application are on the agenda.

The complex of positive properties of basalt, simple nanotechnology, lack of reinforcing shops and harmful to people and the surrounding environment (ecology) of welding productions, availability and low cost of raw materials, all these qualities promise development of the industry of without welding nanotechnology for production of the national teams of concrete goods and monolithic building constructions and constructions of high durability, reliability and durability in the nearest future. The basalt nanofibre manufactured in Russia is commercially favorable product of export and conforms to all requirements of the German DIN standards (Deutsches Institut für Normung) for everything complex of the construction industry of Germany from the Russian basalt. In article of the German magazine „Beton- und Stahlbetonbau" in October 2017 [7], the State of Baden-Württemberg (Albstadt-Ebingen, Baden-Württemberg) from carbon fibers (Carbonbeton) is reported about construction of the first pedestrian and bicycle bridge (Figure 3 & 4) in the German city of Albshtadt-Ebingen. At the University of Stuttgart, at institute of construction materials, professor H.W. Reinhart (Professor Hans-Wolf Reinhardt, Universität Stuttgart, Institut für Werkstoffeim Bauwesen) and at the technical higher school of the city of Aachen (Rheinisch-Westfälische Technische Hochschule Aachen) within about 20 years conducted a research and test "innovative" and "first-ever" (as it is specified in the German magazine „Beton- und Stahlbetonbau") concrete with carbonic fiber. When replacing standard steel fit-

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tings by carbon fibers: "the durability, wear resistance and reliability of a design as the received carbon fabrics-concrete have the high density and shock durability is increased" - in article of the German magazine the highest guarantees and vast prospects of this "first-ever" ("Dieweltweiterste") bridge are given: "... die Relevanzund das Markt-und Anwendungs potenzial Innovation" - in the text of article.

Figure 3: Pedestrian Bridge in Germany, the city Albstad-Ebingen constructed as the very first experiment of concrete on the basis of carbon fiber (Carbonbeton), 2016.

Figure 4: Pedestrian Bridge in Germany, the city of Albshtadt-Ebingen, the first in Western Europe experiment from carbon fiber, 2016.

However it is necessary to add: operating conditions, that is climate in Germany considerably differs from climate of Russia (Figures 5 & 6), and it is necessary to consider: more than 30 years ago in Moscow successfully applied basalt nanofibre to different concrete goods on domestic industrial (!) technology, at the same time our composite nanotechnology of basalt more frost-resistant and more chemical and heat-resistant, than carbon (plastic) German fiber. It is necessary to know and remember: basalt has

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one more preferable decisive advantage: it is one of the natural minerals, most widespread in the nature, the basalt source of raw materials in Russia is huge. It is possible to choose rationality of use of basalt or carbon fiber for receiving concrete as joint tests of samples in laboratory, with obligatory calculation: comparative economic effect, check on a frost resistance, a salt resistance, water tightness, durability, cavitation.

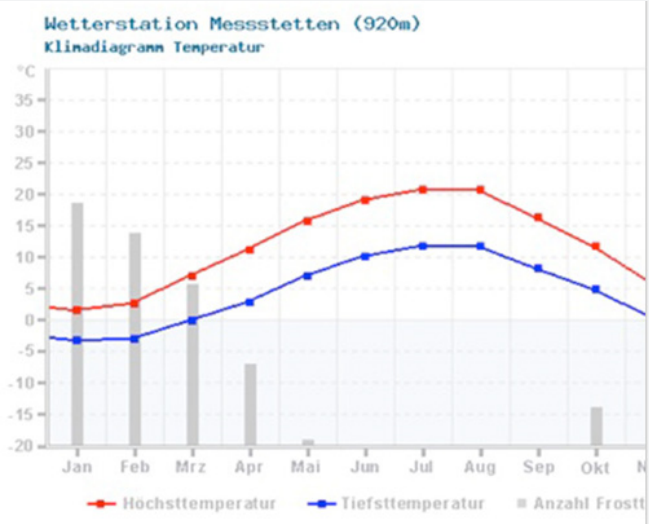

Figure 5: Climate in the region Albshtadt-Ebingen: measurements show the lowest temperature of year in December, January, February - is not lower minus 3 degrees Celsius. On the chart: red noted the maximum air temperatures, blue – the minimum air temperatures, gray – the number of "cold" days in a month.

Climate of Moscow: for the entire period of observations (1879 - 2017 data of TSHA All-Russia Exhibition Centres)

Indicator Apr Mai Iyong Jul of Aug Seong Okt Nov of Dec Year	Jan	Feb	Map	Apr	Mai	Jn	Jul	Aug	Sen	Okt	Nov	Dec	Year
Max, °C	8,6	8,3	17,5	28,0	33,2	34,7	38,2	37,3	32,3	24,0	14,5	9,6	38,2
Middle , °C	−9,1	−9,9	−4,3	2,7	7,9	12,1	14,7	12,6	7,6	2,6	−3,3	−6,8	2,1
Min, °C	−42,2	−38,2	−32,4	−21	−7,5	−2,3	1,3	−1,2	−8,5	−16,1	−32,8	−38,8	−42,2
Norma rainfall, мм	52	41	35	37	51	80	85	82	68	71	54	51	713

Figure 6: Climate of Moscow.

Conclusion

The most important difference and uniqueness in application for production of concrete - universality of basalt fiber:

i. basalt nanofibre of decade is made on standard technology by the plants making a mineral wool for thermal insulation and the finished standard certified product was applied to concrete goods of concrete goods in 1985;

ii. carbonic fiber was made in Germany on the separate special not certified technology purposefully intended for concrete construction that initially raises the price of its cost and application. - Injurious-thuggish "privatization" of all enterprises of Russia with mass use of artificial bankruptcies and raider captures, as a result composite nanotechnology from basalt fiber, also as well as very many others domestic the newest and the most perspective in the world was in the early nineties organized (the presents innovative!) inventions were buried.

Acknowledgments

The Scientific and Production Works of Boris Trinker, a worthy student of the great scientists of Russia D.I.Mendeleev, P.A.Rebinder, V.N.Yung, found effective and profitable application in the works of Alexander Trinker.

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