نوآوران
صنعت
سیلک

Sialk
Industrial
Innovators

نوآوران صنعت سیلک

- بسیار سبک
- تحمل بار بسیار بالا
- عایق خوب صوتی، حرارتی و رطوبتی
- مقاوم در مقابل خوردگی و پوسیدگی
- مقاوم در برابر زلزله، ضربه و خستگی
- سهولت شکل‌دهی و سرعت بالای اجرا

شركة سيلك مبتدعو الصنعة

- الوزن الخفيف للغاية
- قوة عالية
- عزل جيد للصوت والحرارة والرطوبة
- مقاوم مقابل التاكل و الصدا
- مقاوم مقابل الزلزال و الصدمة و التعب
- سهل التركيب بالسرعة العالية للتنفيذ

Sialk Industrial Innovators

- Extreme lightweight
- High strength
- High endurance in impacts, vibration/quakes, and fatigue
- Sound and heat insulation
- Humidity insulation, and rust proof
- Convenient and quick installation

Сиальк Новаторы Промышленности

- Чрезвычайно легкий
- высокая несущая способность
- Звуконепроницаемый, теплоизоляционный и влагостойкий
- Устойчивый к коррозии и гниению
- Устойчивый к ударам, землетрясениям и усталости
- Удобная и быстрая установка

3D Woven Fiberglass Fabrics
3D Woven Fiberglass Composites

پارچه سه‌بعدی بافته شده با نخ شیشه
صفحات کامپوزیت تقویت شده با پارچه سه‌بعدی بافته شده با نخ شیشه

3D-ткани из стекловолокна
3D-тканые композиты из стекловолокна

قماش ثلاثي الابعاد منسوج مع الالياف الزجاجية
صفائح مركبة معززة مع قماش ثلاثي الابعاد المنسوج مع الالياف الزجاجية

تلفن: ۸۸۷۹۷۱۸۸-۰۲۱
۸۸۸۸۹۱۸۰-۰۲۱
دورنگار: ۸۸۷۷۶۲۹۴-۰۲۱

تهران، بلوار آفریقا، کوچه دامن افشار،
شماره ۱، واحد ۶
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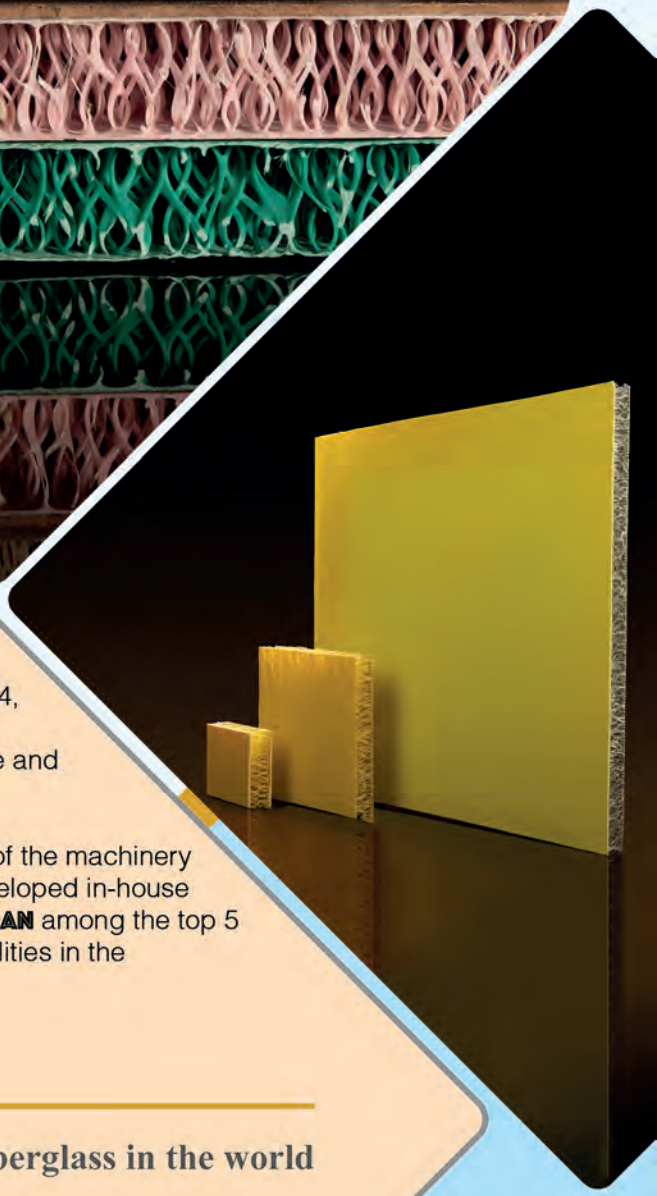

The Company, officially established in 2013, grew out of the outcome of the scientific research by a group of academics as early as 2005. Soon after establishment, it began to produce advanced technical textiles with different types of fibers and threads, including through the production of 2D and 3D fabrics, using fiberglass roving as well as composite panels reinforced by these types of 2D/3D fabrics. The academic research projects led to the registration of three patents by 2014, which helped the Company to be recognized as a knowledge-based company by the Ministry of Science and Technology.

The technical knowledge required for the production of the machinery and the production processes have been entirely developed in-house by the Sialk Industrial Innovators itself, thus placing **IRAN** among the top 5 countries in the word enjoying such advanced capabilities in the manufacturing of machinery and industrial fabrics.

IRAN

The sixth top producer of 3D woven fiberglass in the world

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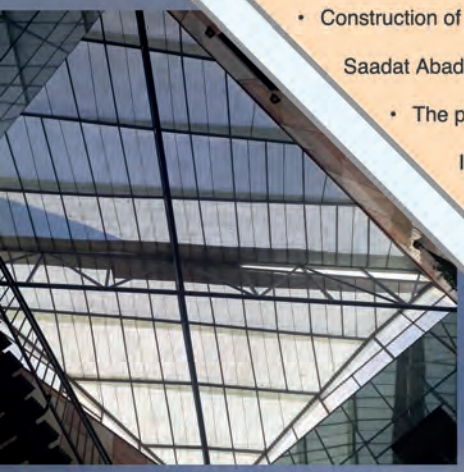
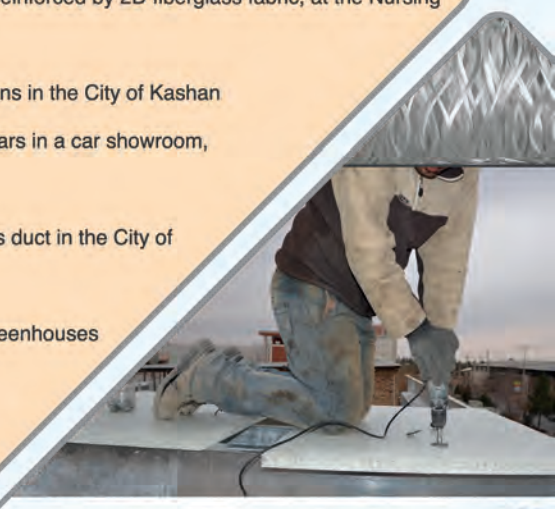
Sialk Industrial Innovators

Current Projects: Completed or in Progress:

- Construction of a 3-story building by combining LSF structures and hollow composite panels reinforced by 3D woven fiberglass fabrics– situated in Ravand Industrial Township, City of Kashan
- Construction of a production line walkway corridor for Narmine and Behtaban Companies
- Reinforcing the concrete through the use of 2D fiberglass fabric in building the floors of a 5-story parking lot for a total area of area of 10000 square meters, City of Kashan
- Reinforcing the concrete through the use of 2D fiberglass fabric in the project for building the floors of a building complex of Abe-Shirin agro-industry co., near City of Kashan.
- The project of building the roof of an auditorium in a total area of 1240 square meters through the use of 3D composite panels covered by a 4-centimeter plain cement, in Mashahd-e-Ardahal
- Manufacturing of manhole hatches for Tehran Municipality, 2019
- Construction of an additional story in old buildings, including the building of a district municipality, City of Kashan
- Construction of 6 stories for a total area of 600 square meters required for the installation of HVAC equipment, at West Nikan Hospital, Tehran, 2019
- Construction of roof skylights through the use of composite panels reinforced by 2D fiberglass fabric, at the Nursing College, Medical University, City of Kashan, 2019
- Installation of about 200 car-drive bridges at street junctions in the City of Kashan
- Construction of a split-level floor for exhibiting new cars in a car showroom, Saadat Abad District, Tehran
- The project of covering ground installations duct in the City of Isfahan
- Covering the roof of industrial greenhouses





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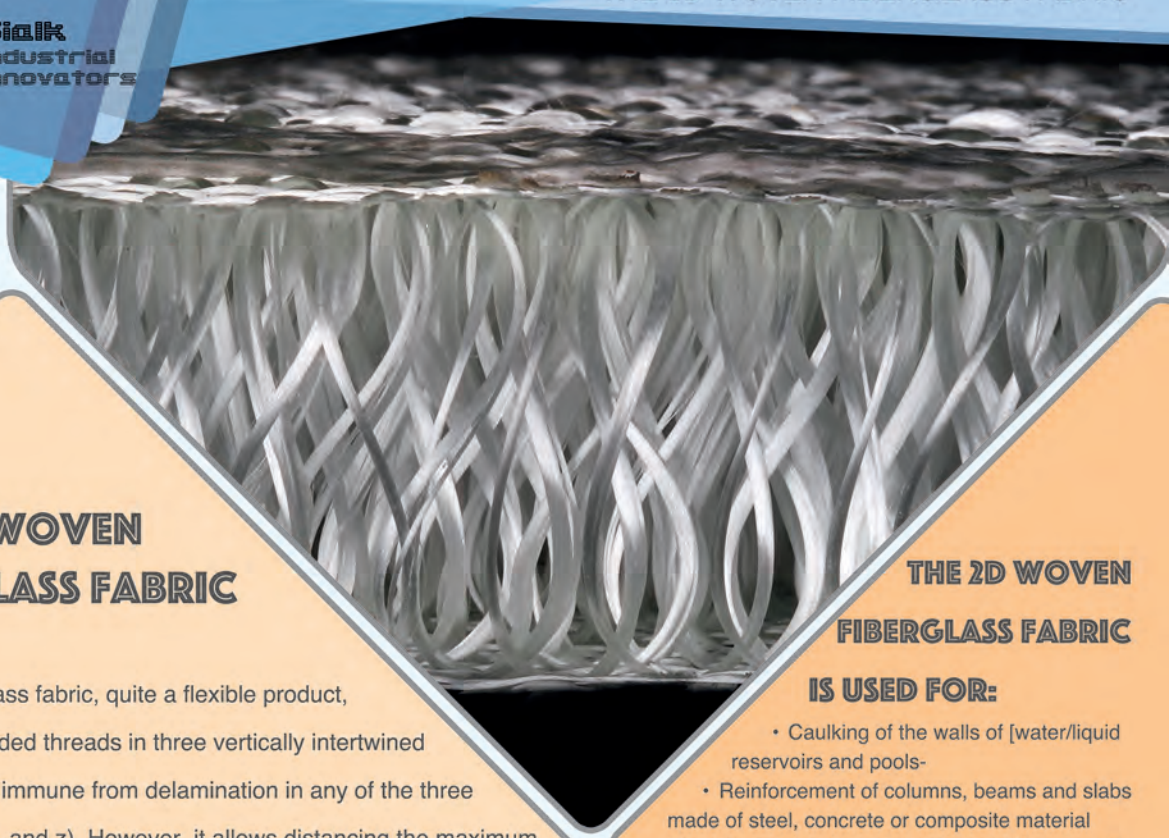

THE 3D WOVEN FIBERGLASS FABRIC

The 3D fiberglass fabric, quite a flexible product, comprises braided threads in three vertically intertwined directions. It is immune from delamination in any of the three directions (x, y, and z). However, it allows distancing the maximum mass from the center, endures the maximum bending moment, as well as enhances the strength-to-weight ratio.

The capability acquired in the manufacturing and production of these fabrics is considered a valuable technological achievement.

The Sialk Industrial Innovators has successfully passed all the necessary laboratory and industrial stages in the manufacturing of this type of advanced fabric in the course of a totally in-home decade-long scientific research, and has secured the patent in Iran.

THE 2D WOVEN FIBERGLASS FABRIC IS USED FOR:

- Caulking of the walls of [water/liquid reservoirs and pools-
- Reinforcement of columns, beams and slabs made of steel, concrete or composite material
- Caulking the joint edge of adjacent 3D composite panels
- Reinforcement of the concrete instead of the steel mesh
- Building of signs and their stands

- **Weaving of 3D fiberglass fabric with a maximum width of 4 meters and unlimited length**
- **Production of 3D woven fiberglass fabric with the thickness ranging from 7 to 42 millimeters**

SIALK INDUSTRY INNOVATORS COMPANY IS THE ONLY PRODUCER OF THE 42-MILLIMETER- THICK 3D FABRIC

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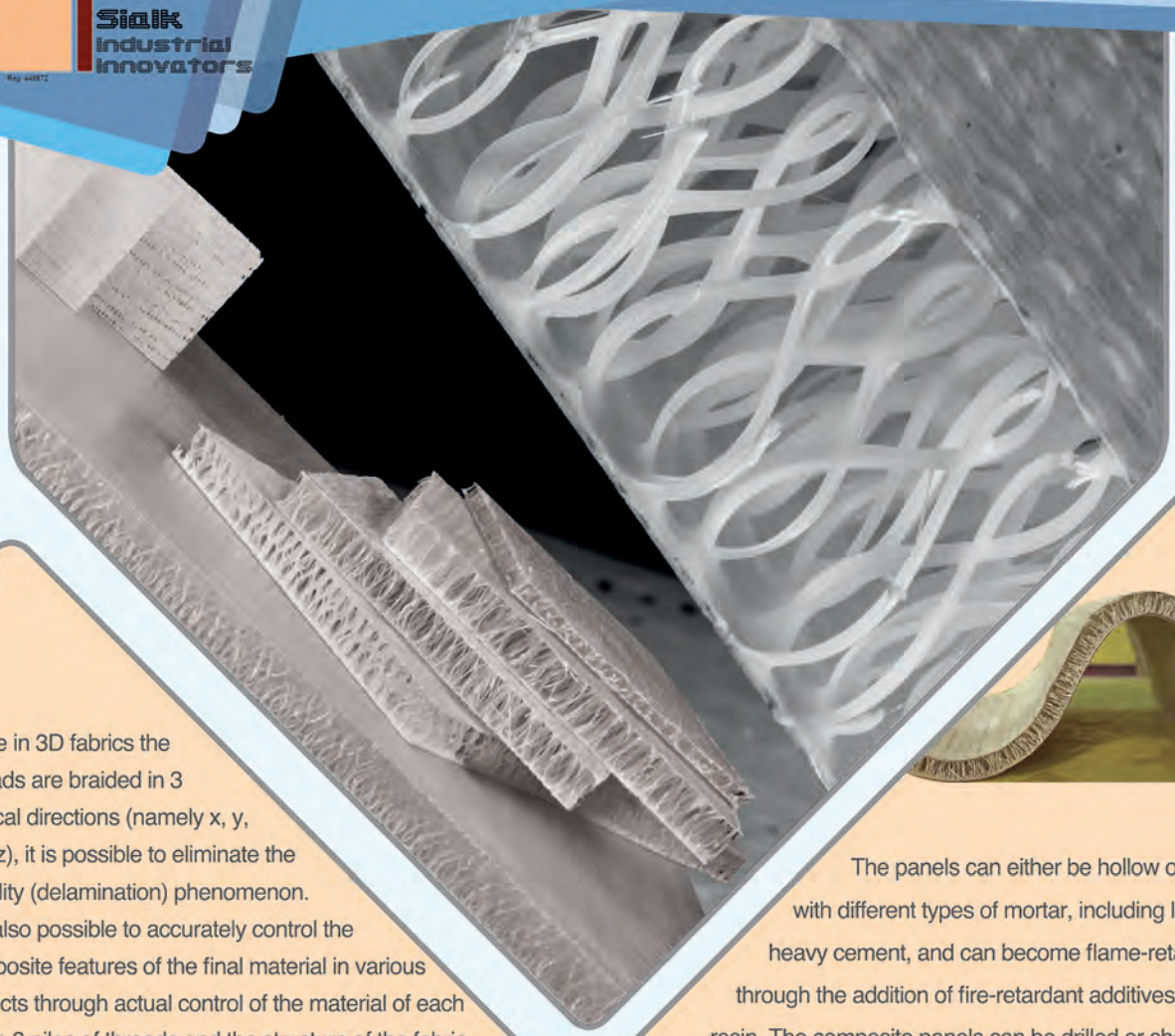
THE 3D COMPOSITE PANELS



Since in 3D fabrics the threads are braided in 3 vertical directions (namely x, y, and z), it is possible to eliminate the ductility (delamination) phenomenon. It is also possible to accurately control the composite features of the final material in various aspects through actual control of the material of each of the 3 piles of threads and the structure of the fabric. The Company has developed innovative solutions for producing the building load bearing components through the various types of hollow composite panels (weighting between 3 and 5 kilograms per square meter) or mortar-filled panels with extraordinary flexural strength, high pressure tolerance, and high strength-to-weight ratio, as compared with other similar materials.

The panels can either be hollow or filled with different types of mortar, including light or heavy cement, and can become flame-retardant through the addition of fire-retardant additives to the resin. The composite panels can be drilled or sheared.

The 3D composite panels, made from different types of epoxy and polyester resin, can be produced in the form of panels with a 4-meter width (and unlimited length) with a thickness ranging between 5 and 32 millimeters. But, typically, they are produced with a width of 150 centimeters and a length of 240 cm.

Properties	*Value*	*standard Test Method*
Thermal Conductivity	0.08 (W/mK)	Din 52616
Thermal Resistance	0.28 (m^2K/W)	-
Compressive Strength	8.8 (N/mm^2)	ASTM 365
Shear Strength	1 (N/mm^2)	ASTM 273
Shear Modulus	13.4 (N/mm^2)	ASTM 273
Bending Stiffness	55.9 (Nm^2)	ASTM 393

The maximum mechanical and thermal features of the 3D composite fabric (resin polyester, within the range of up to 22 mm thickness, without mortar filling)

(the amounts depend on the thread Tex number, type, thickness and density in each direction)

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SIALK INDUSTRY INNOVATORS

Has undertaken serious efforts to present inclusive and competitive technology, products and platforms, for which it has received many certificates and accreditations from the scientific centers in Iran. The composite panels produced by Sialk Industrial Innovators has been carefully examined and certified by the well-known research centers in Iran. Some of the certificates awarded to the Company are as follows:

- Technical Certificate for the use of hollow or filled with grout/mortar composite panels as structural load bearing ceiling cover (from the Road, Housing & Urban Development Research Center, Ministry of Roads & Urban Development, 2018-2020)
- Extensive examinations on structures, fire, and heat (the Road, Housing & Urban Development Research Center. 2015-2017)
- Capacity of the panels in load bearing, as above
- Certificate for Heat Deflection Temperature-HDT test (Iran Polymer and Petrochemical Institute, 2015)
- Certificate for Thermogravimetric Analysis-DMTA Tg (Iran Polymer and Petrochemical Institute, 2015)
- Certificate for the flammability and moisture content test (the Laboratory of Razi Applied Sciences Foundation, 2015)
- Patent for the "weaving 3D fiberglass fabric by a face to face weaving machine, 2014
- Certificate for the knowledge-based Products (the Office of the President, Deputy for Science and Technology, 2013)
- Technical certification (Iran Composite Institute, Iran University of Science and Technology2014)

CONSTANT IMPROVEMENT IN INNOVATIVE STRUCTURES INNOVATION IN PROCESSING, MANUFACTURING OF PRODUCTS, AND IN PERFORMANCE

Sialk Industrial Innovators

CONSTRUCTION INDUSTRY

- Walls and ceilings
- Quick accommodation, especially in crisis situations
- Partitions
- Building blocks
- Reinforcement of old buildings against earthquakes
- Addition of extra stories to buildings without requiring reinforcement of
- **Extremely lightweight with high bearing capacity**
- **Easy to shape**
- **Excellent thermal insulation and sound attenuation**
- **Excellent resistance against corrosion and decomposition/decay**
- **Quake resistant**

WATER AND SEWAGE / OIL AND PETROCHEMICALS

- Water and sewage manhole hatches
- Large-size oil reservoirs and their Isolation
- Water transportation canals and sewage system and their Isolation
- High-speed liquid pipes containing floating particles
- Large-size water reservoirs and pools and their Isolation

PUBLIC TRANSPORTATION

- Roofs and floors of buses
- Floors and decks of lightweight boats
- Hulls and decks of ships
- Stealth unmanned aircrafts
- Road guardrails
- Road and traffic signs

COMPOSITE CONEXES, CABINS AND SHELTERS

- Conexes for accommodating
- Stealth shelters and structures
- Lightweight, portable and stable cabins and containers, suitable for long-time burial underground
- Anti-EMP bomb (Electromagnetic) cabins
- Sound absorbent cabins (attenuator, silencer)

Fast installation-dismantling
Easy and light transportation
Extremely light and stable
Possibility of reuse
Thermal and moisture insulation and sound attenuator

REINFORCEMENT OF STRUCTURES

- Reinforcement and protection of subsurface structures against corrosion
- Reinforcement of metal structures; e.g., steel columns and bridges
- Production of pipes, slabs, angle bars and boxes with high strength-to-weight ratios and resistant to fatigue, corrosion, and decomposition/decay.

CIVIL CONSTRUCTION AND URBAN/INTERURBAN FACILITIES

- Footbridges and crossroads bridges
- Streets side curb blocks; replacement of current curb blocks with composite blocks with high resistance and longer life span
- Tactile paving
- Enduring coverage of old and damaged curb blocks
- Sunshades and parasols in urban structures

PROTECTION OF CONCRETE WALLS

- Protection of concrete walls against corrosion
- Reinforcement of concrete surfaces

INDUSTRIAL GREENHOUSES

- Coverage of greenhouse walls and roof
- Provision of adequate lighting for the greenhouses
- Protection against ultra-violate rays
- Ensuring longer lifespan (up to ten times when compared with current materials in the market)
- Energy conservation
- Decrease in the weight and number of frames in structures

OTHER APPLICATIONS

The applications requiring the following features:

- High strength-to-weight ratio, easy to shape, and quick installation
- Excellent sound attenuation, thermal and moisture insulation with high corrosion and decay/decomposition resistance
- Resistance against quake, impact, and fatigue

Sialk Industrial Innovators

FLAMING AND HEAT TESTS

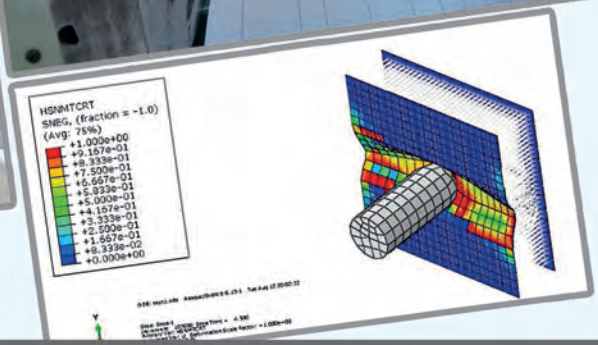
- Primary flaming test
- Tg test (Thermogravimetric analysis)
- HDT test (Heat deflection temperature test)
- Flammability test
- Water absorption test

PHYSICAL TESTS

- Light transmission spectrometry test
- Testing of the impact of cold weather on bending strength
- Sound insulation test
- Ultra-violate test
- Acid resistance test

STRUCTURAL TESTS

- Four-point bending tests
- Bending, tension and deflection tests
- Modeling of the composite's bending behavior under distributed loads
- Shear strength tests
- Surface compressive strength test
- Quasi-static pounding and impact strength test
- Modeling of mechanical behavior of 3D composite



Sialk Industrial Innovators

3D COMPOSITE PANELS FOR CEILINGS

The 3D composite panels produced by the Sialk Industrial Innovators have served as a revolutionary contribution to the construction industry through producing different types of composite panels, either hollow or filled with light or heavy grout/mortar, also taking advantage of the exclusive features of 3D composite structures with high strength-to-weight ratio, which have helped to decrease the structure's deadweight. These panels can be efficiently used in construction industry, especially slabs as for walls and load bearing coverage of the ceilings.

- Significant increase in some building mechanical strength such as fatigue strength
- Decrease in the time required for construction projects delivery, including decrease in labor expenses
- The positive impact of reduction of ceiling's weight on the design of the load- bearing components of the structures
- The feature of not requiring heavy machinery and equipment
- Easy transportation of building materials, especially in old and worn-out urban textures
- The feature of simultaneous use of the load bearing panels as heat and moisture insulation and sound attenuator

THE COMPETITIVE MERITS

- **Lightweight combined with high load bearing**
- **Efficient heat and moisture insulation and sound attenuator**
- **Resistance against corrosion and decomposition/decay**
- **Resistance against quake, impact, and fatigue**
- **Easy to shape, and quick installation**

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CONEXES

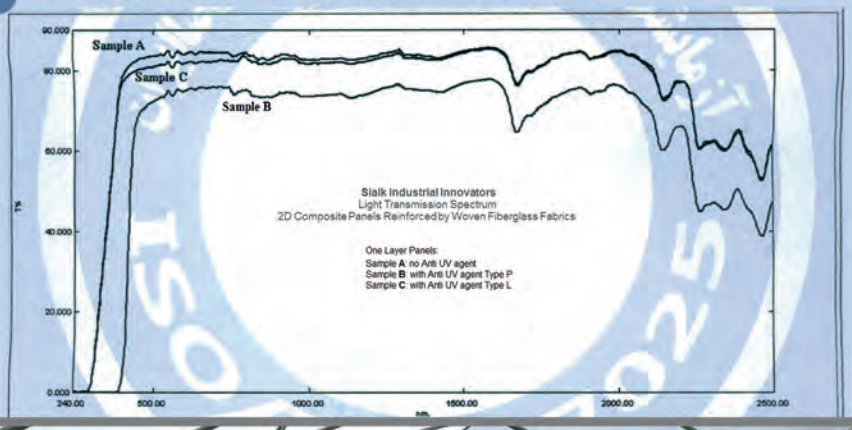
3D composite panels in the form of walls and ceilings are both reusable and easy to carry. They can also serve as thermal, moisture and sound attenuator in the walls, and may even ensure adequate natural lighting for the interior space of conexes.

COMPETITIVE MERITS

- Quick and frequent assembly, involving the least amount of damage
- Easy assembly without requiring specialized technicians or electrical equipment
- Extendable to various sizes and in all four directions
- Adequate flexibility for installation of doors and windows
- Easy to carry, either by hand, and in difficult terrains and situations, or by a light pick-up van
- Due to the good thermal insulation, the interior space of conexes can be cold in summer and warm in winter
- Provision of daylight for the interior space of conexes without vision from outside
- The features of being good sound attenuator, waterproof and anti-rusting, provide a calmer and a longer lifespan in humid areas
- Possibility of frequent reuse, including in converting temporary shelters to permanent accommodations

Sialk Industrial Innovators

Light Transmission Spectrum for 3 Samples in the 240 ~ 2500 Nano meter wavelength band using Beam Spectrophotometer equipped with Integrating Sphere



SIALK INDUSTRIAL INNOVATOR has produced its 2D and 3D clear composite panels for use in industrial greenhouses coverage. Due to their longer life span, use of such panels can be considered a suitable replacement for nylon and polycarbonate covers. This also ensures economical good quality and energy efficiency.

Light transmission spectra tests have established that these panels provide a very good choice for greenhouse covers.

- High resistance against sunlight and environmental factors
- Reduction of thermal conductivity, and energy saving
- Passing adequate light commensurate with greenhouse needs
- Reduction of weight through the use of a smaller number of greenhouse frames

IRAN

THE SIXTH TOP PRODUCER OF 3D WOVEN FIBERGLASS FABRICS IN THE WORLD

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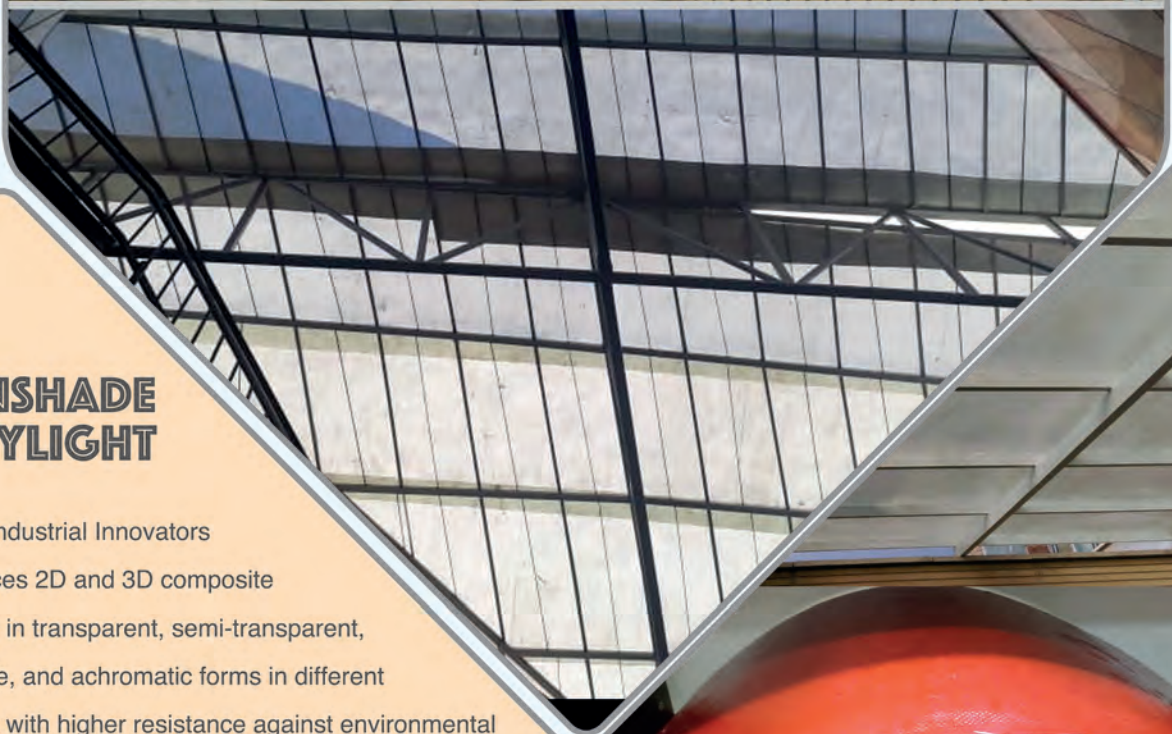


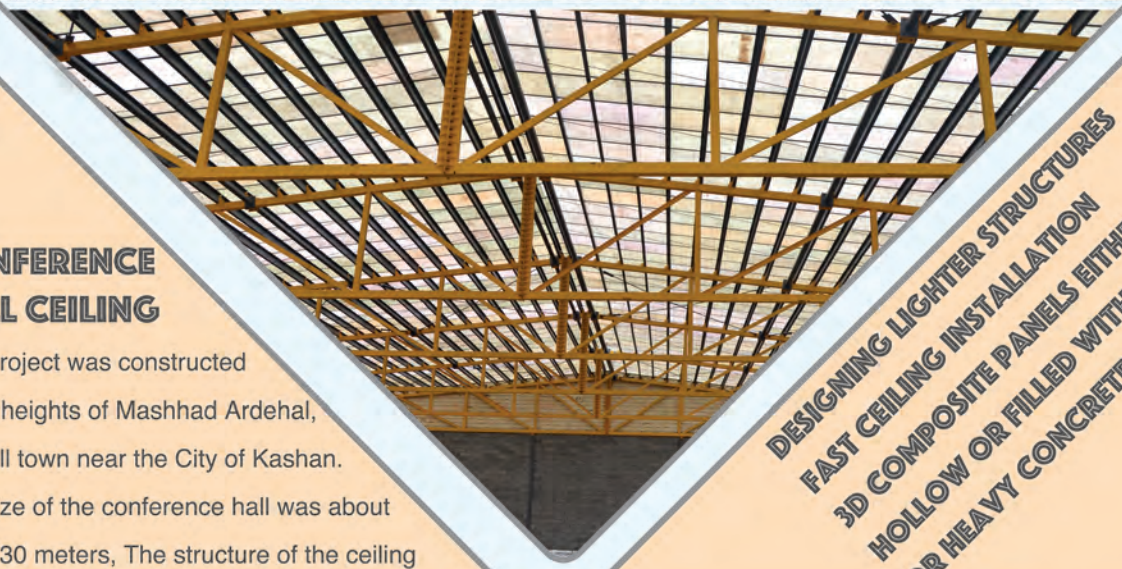
SUNSHADE -SKYLIGHT

Sialk Industrial Innovators produces 2D and 3D composite panels in transparent, semi-transparent, opaque, and achromatic forms in different colors; with higher resistance against environmental factors. The longer life span of these resistant panels makes them a highly competitive alternative for the currently used polycarbonate covers in hall ceilings, city canopies, footbridges, parking lots, taxi and bus stations. Installation of skylights for a medical college and shading footbridges in the City of Kashan in 2019 stand out as two successful projects for the use

PANELS REINFORCED BY 2D WOVEN FIBERGLASS FABRICS:

ENJOY HIGHER RESISTANCE AGAINST ENVIRONMENTAL FACTORS, HEAT AND SUNLIGHT, LONGER LIFE SPAN, AND ECOSYSTEM FRIENDLY

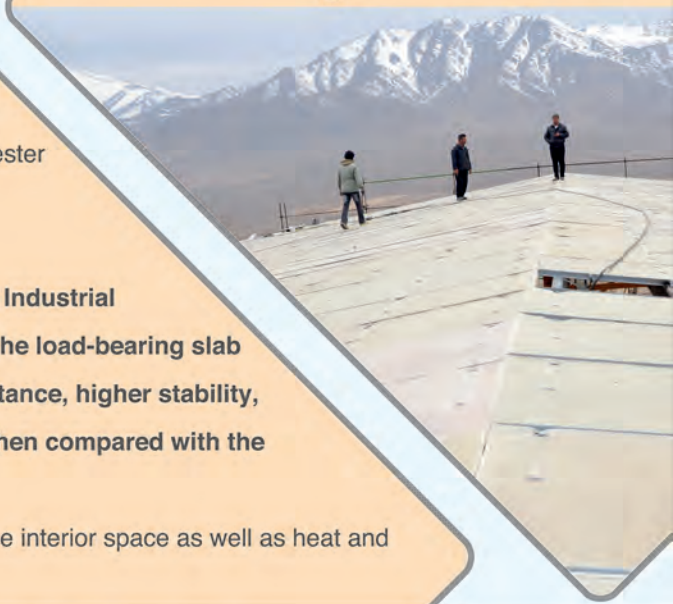
Sialk Industrial Innovators



CONFERENCE HALL CEILING

This project was constructed at the heights of Mashhad Ardehal, a small town near the City of Kashan. The size of the conference hall was about 41 by 30 meters, The structure of the ceiling consisted of roof truss designed by Z rods and the axes distanced from each other between 50 and 58 centimeters. In making the ceiling, 3D composite panels with 3.2 density, 2.7 centimeter thickness, and normal polyester resin was used.

DESIGNING LIGHTER STRUCTURES
FAST CEILING INSTALLATION
3D COMPOSITE PANELS EITHER
HOLLOW OR FILLED WITH LIGHT
OR HEAVY CONCRETE FOAMS



The 3D hollow composite panels produced by the Sialk Industrial Innovators are used as ceiling coverage in the form of the load-bearing slab of the ceiling, which enjoys such features as high resistance, higher stability, faster installation, and more economical – especially when compared with the traditional ceiling covers.

The 3D hollow panels can also provide adequate light for the interior space as well as heat and moisture insulation.

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REINFORCEMENT OF CONCRETE FLOORS OF PARKING LOTS AND DOCKS

Reinforcement of concrete floors of parking lots and docks

Flooring of the multi-story parking lots which also needs a certain degree of slope, usually made with metallic mesh.

Sialk Industrial Innovators has presented an alternative solution for substituting the metallic mesh for flooring projects with the production of low density 2D woven fiberglass fabrics (Weft/Woof density of 1.8 to 2) in the form of rolls of up to 4 meters width.

The Company has successfully executed a number of projects, involving large-size parking lot concrete floors, and agriculture complex load-unload concrete dock platforms, with the use of 2D woven fiberglass fabrics.

USE OF SIALK INDUSTRIAL INNOVATORS 2D FABRICS FOR FLOORING AND CONCRETE

QUICK INSTALLATION
REDUCTION OF CONSTRUCTION EXPENSES
REDUCTION OF THE STRUCTURE'S WEIGHT

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PERFECT SUBSTITUTE AND ALTERNATIVE FOR THE CURB BLOCKS

Sialk
Industrial Innovators
has presented a product from the combination of 3D composite panels and concrete mortar which makes a perfect substitute and alternative for the curb blocks.

Sialk blocks are extremely durable and stable against bumping impacts and environmental conditions, while so elegant.

Another innovative and economical product of Sialk Industrial Innovators is the cover for the old and damaged curb blocks. These cover of old curb blocks, need neither damaging nor replacing the old ones.

PERMANENT COVER FOR OLD CURB BLOCKS INSTEAD OF REPLACING THEM

COLORFUL COMPOSITE BLOCKS AS SUBSTITUTE FOR OLD CEMENT CURB BLOCKS

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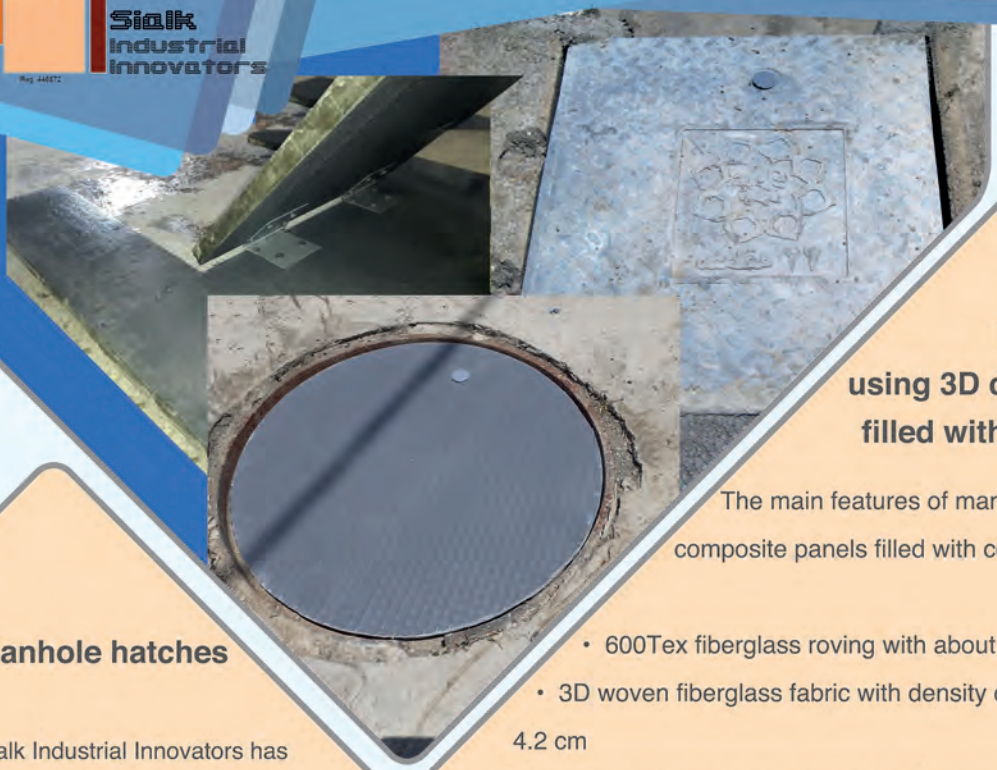
Sialk Industrial Innovators



Manhole hatches using 3D composite panels filled with concrete mortar

The main features of manhole hatches made composite panels filled with concrete mortar:

- 600Tex fiberglass roving with about 2 GPa tensile strength
- 3D woven fiberglass fabric with density of 3 and thickness of 4.2 cm
- Polyester resin as matrix, creating 3D composite panels with a thickness of 3 cm
- Cement

Sialk Industrial Innovators produces 3D composite panels suitable for manhole hatches in the following shapes:

Rectangular, circular, with handles, and with easy-to-open doors.

These products have been widely welcomed by city municipalities.

Manhole hatches

Sialk Industrial Innovators has introduced manhole hatches through the use of 3D composite panels filled with concrete mortar. These panels possess the necessary technical requirements and strength; and since have no recyclable parts, also decrease the incentive and risk of being stolen.

The extensive use of manhole hatches in modern cities makes their actual guarding almost impossible. Use of the hatches made of non-recyclable material lowers the risk of stealing for recycling purposes.

3D COMPOSITE MANHOLE HATCHES

NEW MATERIAL AND TECHNOLOGY, SUBSTITUTE METAL AND CAST-IRON HATCHES

LOWER RISK OF STEALING URBAN AND SUBURBAN MANHOLE HATCHES

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TACTILE PAVING, CROSSROADS BRIDGES

Tactile paving

Sialk Industrial Innovators has acquired the technical capability of manufacturing textured panels in order to provide easier paths for the blind.

These panels are produced in a size of 40 by 40 cm (or in the form of 40 cm stripes of any length) in yellow color. The panels can be produced in the form of tiles or as 2D sheets fix which stick on different surfaces.

Footbridges and car bridges

Sialk Industrial Innovators Composite Panels, while being corrosion and rust free, enjoy the strength to bear the weight of automobiles in crossroads. The smooth and gap-free surface of the panels is meant to prevent physical injury to the pedestrians.

The reinforced composite panels – made with 3D woven fiberglass fabrics and filled with concrete mortar - can function as a hybrid composite which enjoys such features as lightweight; and high resistance against bending, tension, impact, corrosion, decomposition and decay. These features qualify these panels for use in drainage canals.

A NEW SOLUTION FOR PATHS' COVER IN CITIES

3D COMPOSITE PANELS FILLED WITH MORTAR

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SIALK INDUSTRIAL INNOVATORS FULL COMPOSITE TRAFFIC SIGNS

Due to extreme lightweight, these panels look thinner and more delicate, with a longer life span and higher safety in case of accidents.

The composite signs and guardrails are highly flexible in case of accidents, and pre-defined breakable upon impact, which would help prevent serious damage or injury.

The use of these composite panels in street signs, traffic signs, billboards, guardrails, and manhole hatches, while highly resistant against corrosion, decomposition, decay, and rust, also serves to erect lighter structures.

Due to the known phenomenon of stealing of metal signs and hatches in urban/suburban areas, use of composite signs and hatches can also help decrease the extent and scope of the problem.

HIGHER SAFETY WITH COMPOSITE TRAFFIC SIGNS IN CASE OF ACCIDENTS

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Thermal insulation of tanks and reservoirs

As a matter of course, the temperature of the liquid in the reservoirs increases due to sunshine or increase in the temperature of the surrounding environment. Decreasing the temperature, however, requires man-made efforts and involves expenditures. **Sialk Industrial Innovators** has contributed to the solution of the problem through the production of hollow 3D composite panels.

Experiments with polyethylene reservoirs have established that if temperature of the surrounding environment stays unchanged at 50°C for 6 hours, the temperature inside the reservoir increases up to 5.7°C. This means the liquid temperature at 20°C increases to a level of 25.7°C during the same time span. It has also been shown that during an 11- hour time span the 20° c temperature increases to 31.5°C.

Use of the 3D composite panels produced by the Sialk Industrial Innovators as the cover for a polyethylene tank, considering a gap of about 2.5 cm between the panels and the tank wall, substantially reduces the increase in the temperature of the liquid; that is, if the temperature of the surrounding environment of about 50 °C remains unchanged for a 6- hour period, the temperature of the liquid inside the reservoir increases only by 0.2° C. It means that if the original liquid temperature is 20 °C, it increase only to 20.2 °C. Further experiments have shown that for a 14-hour period, the temperature experiences a 0.9 °C increase. That points to a substantial difference in the impact of the use of 3D panels on traditional polyethylene tanks.

RESERVOIRS AND POOLS

The 3D composite panels can, on their own, tolerate up to 6 meters of hydrostatic pressure.

The panels can also be used to repair pools and reservoirs.

Sialk Industrial Innovators

Cutting into half the composite panels reinforced by 3D woven fiberglass fabric, in a manner to fit into the walls of the concrete formwork (shuttering)

The smooth resined side is placed against the wall of the formwork (shuttering)

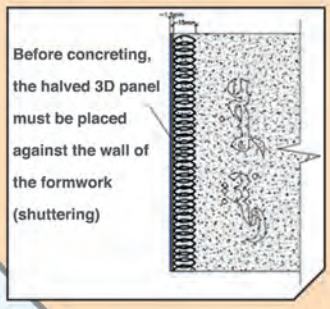
PROTECTION OF CONCRETE WALLS AGAINST CORROSION

Insulation of concrete walls

Silak Industrial Innovators cut 3D composite piles can be easily and comfortably interlaced with and attached to the concrete material, so they can be considered as a practical solution for insulating reservoir walls or concrete walls in severe environmental conditions.

However, the excellent adhesiveness of 2D composite covers provides suitable insulation material for concrete walls and reservoirs in normal environmental conditions.

The composite covers, once reinforced with the fiberglass fabric, can contribute to prevent chloride ion penetration and carbonation as the main elements causing concrete corrosion. Use of these panels serves to reduce damages and increase the longevity of the reinforced concrete



Given strong resin features, these panels are quite resistant against acidic and alkali impact.

INSULATION OF CONCRETE RESERVOIRS AND POOLS
REINFORCEMENT OF CONCRETE WITH 2D WOVEN FIBERGLASS FABRIC

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