

PIUSYS
The pioneer of Polyurethane System



GBS®

GREEN BINDER SYSTEM

The Road starts to breathe



Product Inquiry

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PIUSYS
The pioneer of Polyurethane System

CHAPTER 1

About Us

1. About Us
2. Introduction of GBS®
3. Silica Sand Binder
4. Interior Binders
5. Cork Binder

PIUSYS
SINCE 1985

01

ABOUT US



Head Office

Responsible for all management, planning, and strategy, from product planning to marketing and sales.

- Management & Finance
- Legal & Accounting
- Business & Marketing
- Strategy Planning
- Management of Intellectual Property



R&D Center

Confirm product feasibility of planned products and organize and develop new products.

- Research Planning
- Development Design
- Technical Data Management
- Technical Cooperation
- Quality Management



Factory

The core space where R&D centers directly manufacture proven products.

- Production Management
- Process Management
- Facilities Management



Vietnam Corporation

Overseas corporation where we operate local specialized laboratories and manufacturing plants based on our experience and know-how.

- Management & Sales
- Research planning
- Technical collaboration
- Production Management



BUSINESS Philosophy

TECHNICAL

PIUSYS fulfills customer demands based on our technical knowledge and experience in polyurethane.

TRUST

PIUSYS fulfills our promises with customers faithfully and responsibly.

INNOVATIVE

PIUSYS is enhancing competitiveness by continuously improving our product and production process.

***Annual CAPACITY 22,000 Ton**

1,830 ton/month

PIUSYS's R&D Center comprises 4 research teams, including Rigid Team, Semi-rigid Team, Flexible Team, and PESOL Team.

Based on our expertise, we are developing products that can satisfy the needs of customers in each industrial area.



20%

Research positions account for 20% among all employees (as of 2023)

* Including both Korea headquarters and Vietnam corporation

Development Background

Considering the rapidly changing climate and the need for a sustainable and environmentally friendly energy transition for future generations, PIUSYS has developed a GBS that can realize carbon neutrality (net-zero).

We are continuing to develop the GBS so that it can also serve as a countermeasure against the phenomenon of "green inflation," which occurs when commodity prices rise and prices across the economy rise as we transition to a greener economy.



As a polyurethane based-flooring material, GBS is developed as an eco-friendly alternative of the most widely used as flooring materials in the world which are cement and asphalt. GBS can be made as a concrete form by using natural minerals of different solid phases, such as silica, aggregate, or cork and also can serve as a multipurpose aggregate adhesive as it is shapable in various structures depending on the use.

Benefits of GBS

- **Perfect drainage and water permeability :**
Aggregate coating improves drainage (can drain up to No. 6 silica sand), reduces the deposition of fine dust and emergency water (excellent water retention)
- **Economical :** Good quality control (excellent water retention), high durability, easy to construct and repair
- **Environmental :** Reduces heat island effect in urban centers, recycles water, eco-friendly (tested for 8 heavy metals)
- **Comfort :** Provides physical pharmacist safety (comfortable walking), prevents splashing
- **Aesthetics :** Enables a wide range of colors, upgrades city aesthetics

PIUSYS ' GBS system makes cities healthier and more comfortable.

CHAPTER 2

Introduction of GBS®

GREEN BINDER SYSTEM

The green color of the GBS logo symbolizes biomass, an eco-friendly raw material that is added to GBS, and the design is organized around straight lines and curves to resemble a road.

CHAPTER 3

Silica Sand Binder



Uses of the Structures



Roadway, pedestrian passage (sidewalk, waterside passage), Bicycle road, parking lot, track field, trail, pedestrian overpass, thin-layer polymer bridge pavement, bridge deck, waterproofing coating, road pavement priming, permeable block, and stream erosion prevention

Silica Sand Binder Properties

	Test Category	Unit	Criterion	Result	Standard
Properties (25°C)	Density	g / cm ³	1.1±0.1	1.127	KS M ISO 1183
	Durometer hardness	Shore D	65 or higher	75	KS M ISO 868
	Compressive strength	MPa	150 or higher	272	KS M ISO 604
	Flexural strength	MPa	25 or higher	59.6	KS M ISO 178
	Tensile strength	MPa	25 or higher	42.3	KS M ISO 604
	Tensile elongation	%	15 or higher	26	KS M 3006
	Wear-resistance	mg	100 or less	12	ASTM D 4060
Toxic effect	8 heavy metals	mg / kg	Non-detected	Non-detected	KS G ISO 8124-3

Composition of the Structures



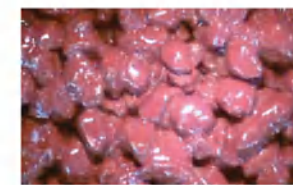
Structures' Standard by Use

* Road pavement material

Roadway Type 1	Roadway Type 2	Sidewalk, Bicycle road Type 1	Sidewalk, Bicycle road Type 2	Parking lot	Thin-layer pavement
Permeable surface layer 50mm	Permeable surface layer 30mm	Permeable surface layer 20mm	Permeable surface layer 20-30mm	Permeable surface layer 20mm	Non-permeable surface layer 5-20mm
Permeable base layer 100mm	Cement / Asphalt pavement	Permeable base layer 30mm	Cement / Asphalt pavement	Permeable base layer 50mm	Cement / Concrete
Roadbed	Roadbed	Roadbed	Roadbed	Roadbed	

Silica Sand Binder Features

Filling structure (cement & asphalt) VS Coating structure (silica sand binder structures)



Permeable asphalt, Cement concrete filling method
10x enlarged image of 5mm aggregates permeable cement concrete



Silica sand binder coating method
60x enlarged image of 0.8mm Grade 4 silica sand

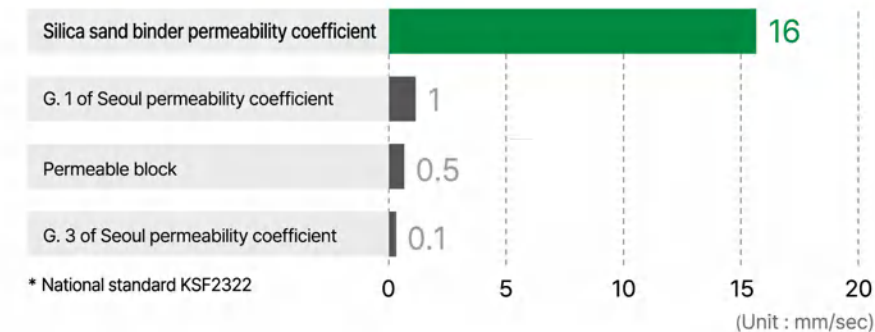
Benefits of Permeability and Drainage

Prevention of sinkholes	Reduction of urban heat island effect	Prevention of hydroplaning
Maintaining permeability rate	Preventing frost damage	Easy rainwater recycling

Based on 5 Grade-Permeability Coefficient of Seoul

City of Seoul Walkway Environment Dept.

Type	Grade 1	Grade 2	Grade 3	Grade 4	Other
Permeability coefficient (mm/sec)	1.0 or higher	0.5 or higher Less than 1.0	0.1 or higher Less than 0.5	0.05 or higher Less than 0.1	Less than 0.05



* As a rule, min. G3 permeability coefficient (mm/sec) is used / Mandatory use of permeable walkway block by Seoul. Applied in Nov. 2012
* Testing method of aggregates and soil permeability coefficient

* National standard KSF2322

Permeable Cement vs Silica Sand Binder Permeable Concrete

Test Category	Unit	Permeable Cement	Silica Sand Binder Permeable Concrete	Performance Difference	Standard
Compressive strength	MPa	12 or higher	24.9	x2	KS F 2405
Flexural strength	MPa	1.2 or higher	9.8	x8	KS F 2408
Compressive strength after Freezing and Thawing (100 cycle)	MPa	9.6 or higher	18.1	x2	KS F 2456 KS F 2405
Flexural strength after Freezing and Thawing (100 cycle)	MPa	-	4.19	More better	KS F 2456 KS F 2408
Permeability coefficient	cm/sec	1.0×10^{-2} or higher	16×10^{-2} or higher	x16	KS F 2322
Slip resistance index	BPN	40 or higher	52	More better	KS F 2375

Construction Method



* Pavement unit : 18kg / 200kg / 250kg

Construction examples



CHAPTER 4

Interior Binders



04

Interior Binders

PIUSYS interior non-yellowing binders allow you to maintain the color of your aggregate because the binder does not change color over time. This gives you more control over your design, and the lack of discoloration means you can mix different aggregates and have them look the same as they did the first time.

Developing an eco-friendly biomass-based interior binder

POLYOL SYSTEM

ISOCYANATE SYSTEM

BIO MASS



Lightweight Aggregate



Crushed Stone



Natural Gravel



Cobblestone



Miscellaneous Gravel



Color Stone

* All organic biofuels, including plants, animals, and microorganisms that can be used as energy from nature.



Eco-Friendly



Abrasion Resistant



Water Permeable

- PIUSYS interior binders can be mixed with natural materials to create environmentally friendly floor pavers.
- No special chemical treatments are required during construction, so there are fewer adverse environmental impacts.
- Due to the excellent binder structure, floor pavers made of a mixture of binder and aggregate are durable and resistant to fading and staining from external environmental changes.
- It has excellent water permeability and can be constructed in a variety of conditions.

Interior Binder Properties

	Test Category	Unit	Criterion	Result	Standard
Properties (25°C)	Density	g / cm ³	1.05 ± 0.1	1.045	KS M ISO 1183
	Durometer hardness	Shore D	65 or higher	77	KS M ISO 868
	Compressive strength	MPa	150 or higher	244	KS M ISO 604
	Flexural strength	MPa	25 or higher	58.6	KS M ISO 178
	Tensile strength	MPa	25 or higher	45.9	KS M ISO 527-2
	Tensile elongation	%	100 or less	29	KS M 3006
	Wear-resistance	mg	15 or higher	12.8	ASTM D 4060
Toxic effect	8 heavy metals	mg / kg	Non-detected	Non-detected	KS G ISO 8124-3

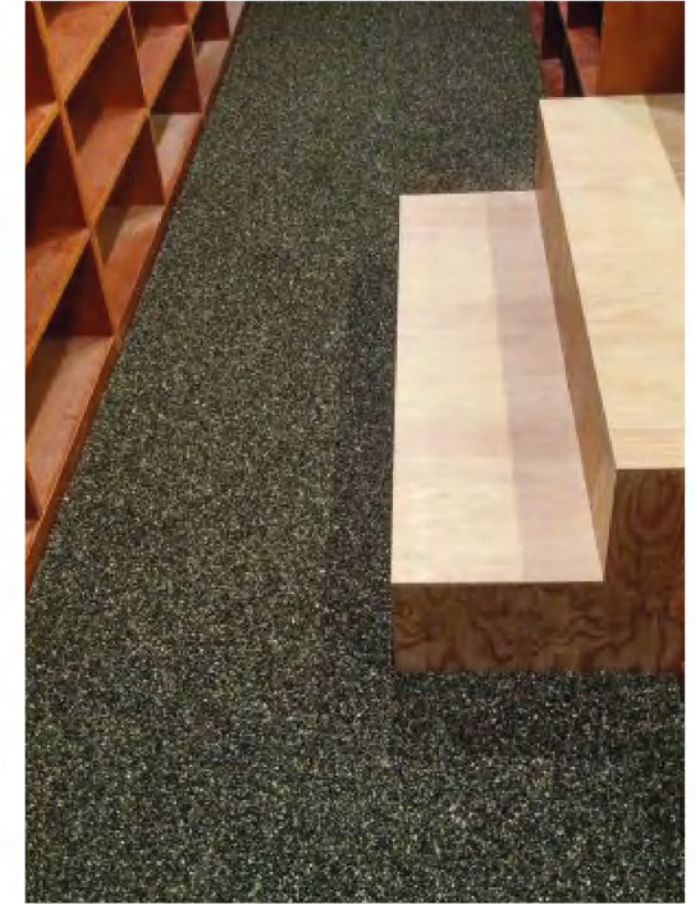
Uses of the Structures

Interior & Exterior

Rooftop landscaping	Roof waterproofing	Park landscaping
Outdoor public spaces (Plazas, Event venues, Exhibition halls)	Indoor public spaces (Apartment buildings, Offices, Hospitals, Steam rooms, Exhibitions)	Car wash flooring (Pervious, Impervious)
Kitchen flooring	Factory flooring	Wood and steel
Coatings (varnishes)	Indoor and outdoor swimming pools	Tree protection plates
Interfloor sound insulation	Playground flooring, cafe and restaurant flooring	Rock climbing holders

04

Interior Binders



CHAPTER 5

Cork Binder



What is cork Paver?

Cork is an eco-friendly material made with 25 years old oriental oak tree, designed not as wine stopper but as an elastic paving material. Cork pave which is constructed with PIUSYS's cork binder has excellent permeability, wear-resistance, shock absorption, antimicrobial effect, low thermal conductivity, and no concern for heavy metal emission.



Chemically safe for human body

5 heavy metals, phthalate-based plasticizers, KS quality standard passed,
* Physically safe for human body



Durability

Passed KS quality standards for tensile strength and elongation, abrasion resistance, and vertical deformation



Physically safe for human body

Passed KS quality standards for slip resistance and shock absorption



Activity & environmental

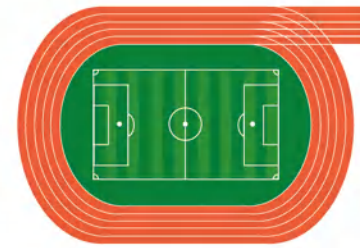
Passed KS quality standards for water permeability, carbon storage, carbon storage capacity

Carbon Storage

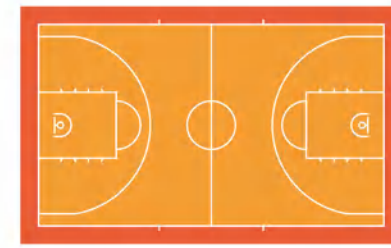
Cork floor pavers can store 142 kg of carbon per 1m³.

Carbon Storage Calculation Results

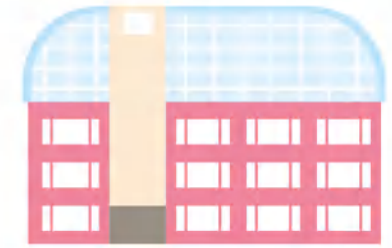
Estimated carbon storage of cork floor packaging (based on 15T) by facility type.



4-lane athletic field track (1,116 m²)
approx. 2,375 kg



Basketball court (420 m²)
approx. 894 kg



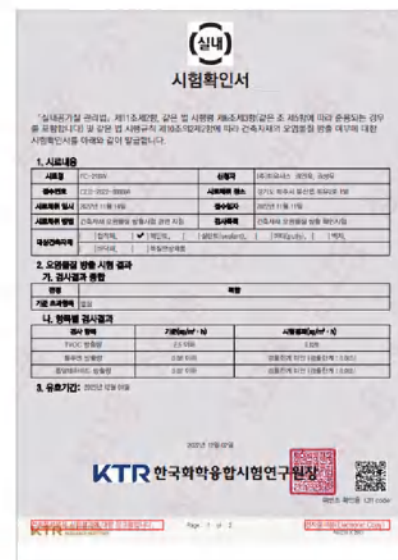
Other facilities (300 m²)
approx. 638 kg

Carbon storage to-volume ratio (kg/m ³)	142	Total 2,405kg carbon is stored in this product			
Carbon storage per unit area with 15T (kg/m ²)	2.1	Installation size (mm)	15	Installation area (m ²)	1,130
Carbon storage per unit area with 65T (kg/m ²)	9.2	Carbon storage per volume (kg/m ³)	142	Total carbon storage (kg)	2,405

* Calculation base :

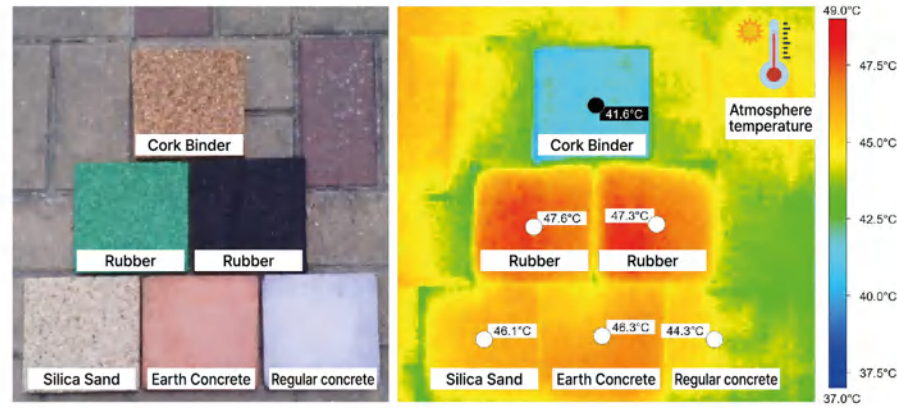
Test results by the Korea Polymer Testing & Research Institute, an international laboratory accreditation institution (Test Report No. KOPTRI-21-05462)

Uses of the Structure



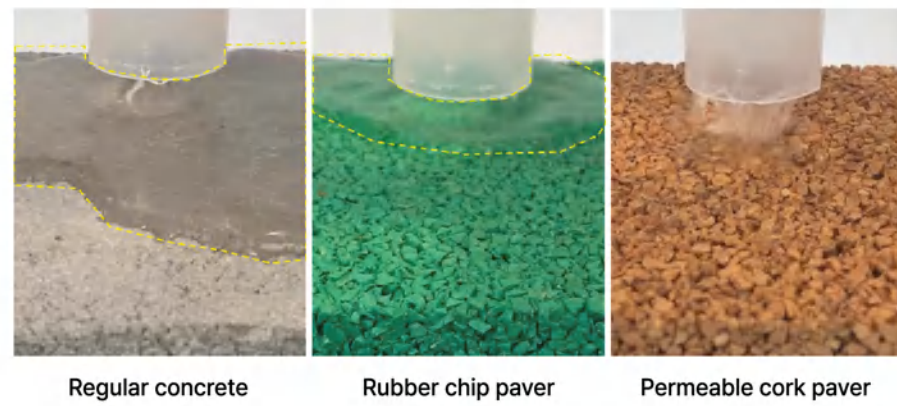
Reduces heat island effect

Significantly lower summer pavement temperatures compared to other pavement materials, allowing for comfortable physical activity and reducing heat island effect.



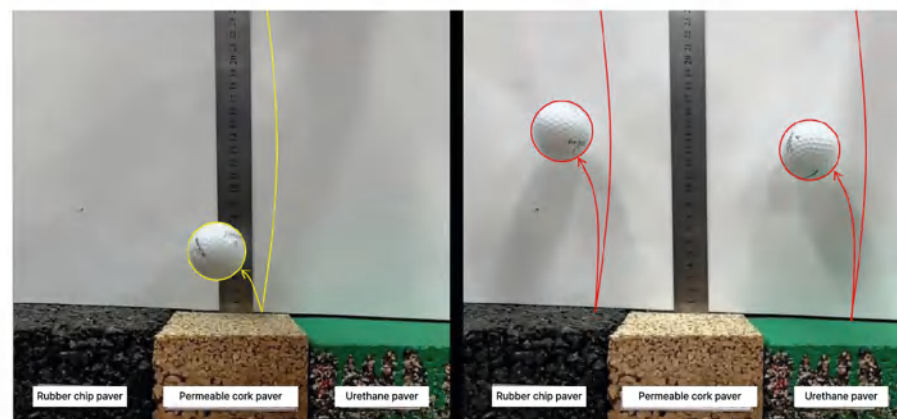
Rainy season permeability

Rainwater drains immediately instead of pooling on the surface, creating a pleasant floor environment and promoting clean groundwater.



Excellent shock absorption

The right amount of elasticity and shock absorption makes for a comfortable walk and less chance of injury in the event of a fall.



Permeable Cork 'Binder' quality standard

Test Category	Quality Standard
Isocyanate Group content (%)	7.0 or higher
Specific gravity	0.98 or higher
Non-volatile portion (%)	97.0 or higher
Viscosity (cP, 23°C)	2500 or higher



- a Of T-VOCs, benzene content must not exceed 1mg/kg or less.
- b PAHs are 18 types, including Naphthalene, Acenaphtylene, Acenaphtene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Phenanthrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(j) fluoranthene, Benzo(k) fluoranthene, Benzo(e)pyrene, Benzo(a) pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h), anthracene, and Benzo(g,h,i)perylene and refers to their total amount.
- c The LOQ of each element must be a maximum of 0.050 mg/L for As, 0.04 mg/L for Cd, 0.007 mg/L for Cr, 0.04 mg/L for Pb, and 0.0005 mg/L for Hg.

Permeable Cork 'Paving Material' quality standard

Test Category	Standard	Test Category	Standard
Thickness (mm)	15 or higher	TVOCs (Mg/kg)	Benzene
Tensile strength (Mpa)	0.5 or higher		Toluene
Tensile elongation (%)	10 or higher		Ethylbenzene
Permeability coefficient (mm/s)	4.0 or higher		Xylene
Slip resistance (BPN)	40 or higher	Heavy metal yield (mg/L)	As
Abrasion loss (mg)	50 or less		Cd
Shock absorption (%)	25~50		Cr
Vertical deformation (mm)	3.5 or less		Pb
PAHs (mg/kg)	10 or less total amount		Hg
			50 or less total amount
			0.1 or less
			0.1 or less
			0.1 or less
			0.005 or less

Construction Methods

* Paving unit : 18 kg / 200 kg / 250 kg



Substrate cleaning and leveling



Primer application



Coated cork chips-binder agitation



Open after curing



Detailed finishing treatment



Laying and compaction

Construction examples

