



Kingwills™  
Advanced Materials

Spark Innovations  
Enrich Life



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# Hypak™

## A "breathing" high-tech material



# Flashspun metamaterial Hypak™

Medical packaging



Building envelopes



Safety protection



Creative life



Industrial innovation



## About Hypak™

Hypak™, a flashspun metamaterial, is a new material with high performance, which is made by flashing process independently developed by Kingwills™. Its structure is both as hard as paper and as soft as cloth. Hypak™, a new material of Kingwills™, fills the gap of China's new material technology industry, and drives the development of

domestic industries in its downstream fields, such as building envelopes, medical packaging, safety protection, industrial innovation and consumer goods, which are used in the highest-end applications including non-woven fabrics and specialty paper, with nearly 100 downstream application scenarios and industries.

## Product characteristics

- 100% polyethylene, with biocompatibility
- Nano-grade high-strength filament, light and high mechanical strength, puncture resistance, dust-free, clean peeling
- The pore size is small but allows gas molecules to pass through, which is waterproof and dustproof and has good breathability performance
- Multi-layer fiber web structure, with excellent microbial barrier
- Anti-aging, non-toxic and non-odor, can be recycled
- Hypak™ has passed the EU REACH and RoHS regulations test and no toxic and harmful substances included

# Medical packaging

Establish a sterile barrier

Sterile barrier system is the basic guarantee of the safety and effectiveness of sterile medical devices and it is the first line of defense against infection and the key factor to prevent hospital-acquired infection. The innermost packaging material in contact with products is the cornerstone of building a sterile barrier system, which shall be compatible with various medical products while blocking microorganisms and other dangerous substances, and ensure that the built-in products are sterile when they are used. Therefore, medical packaging materials need to have excellent barrier properties, high mechanical strength, clean peeling and compatibility with most sterilization methods.

## Hypak™ medical packaging solutions



With the unique nano-fiber network structure prepared by flash-spun, Hypak™ products can effectively block the invasion of bacteria, spores and other easily contaminated microorganisms, so that the packaging of medical devices can always remain sterile until it is opened.



The strong continuous long fiber structure endows Hypak™ products with excellent mechanical properties and provides reliable physical protection for medical devices. Its excellent tear strength and puncture resistance can effectively reduce product recall caused by package damage.



The clean peeling characteristics brought by continuous filament structure can effectively reduce the risk of device contamination and protect the safety of patients.



With the excellent chemical stability of HDPE, Hypak™ products are suitable for almost all conventional sterilization methods, such as ethylene oxide, gamma ray, electron beam, steam (controlled conditions), etc. Before and after sterilization, the microbial barrier characteristics and mechanical properties of Hypak™ products remained stable.



Hypak™ material has good molding and sealing adaptability, and can be made into various packaging forms, such as header bag, breathing bag, medium sealing bag, tray cover material and so on.



Label information can be printed on the surface of Hypak™ material products to realize the traceability of product information.



Hypak™ material is made of 100% high density polyethylene, and its single product component makes it easy to recycle and contribute to sustainable development.

# Building envelopes

Energy-saving, comfort and environmentally friendly

## Challenges facing the construction industry



**Building insulation is the core link of energy saving.** Building insulation system (composed of porous material and air) is easily affected by water vapor, and the thermal conductivity will multiply, thus causing a sharp decline in insulation performance; (Taking rock wool, a common insulation material, as an example, when the moisture content reaches 30%, the thermal conductivity increases nearly 2 times)

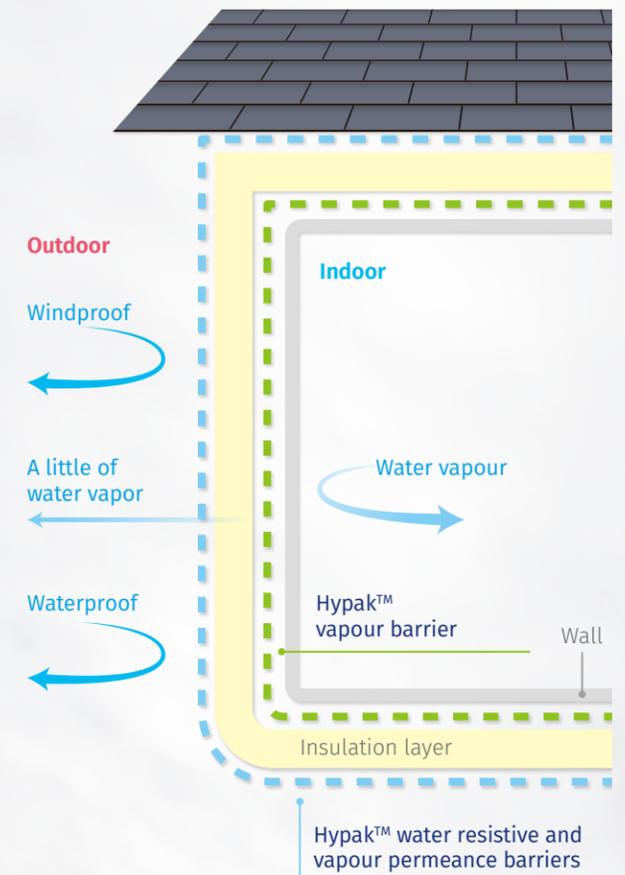
In the absence of wind protection, 3.6 m/s wind (force 3 wind) can easily penetrate the joints or cracks of buildings and enter the internal structure of the external wall of buildings. At this time, **the effect of air convection without wind protection will reduce the insulation performance of the insulation material by 30%**

**The water vapor of building insulation layer does not diffuse timely,** condensed water will accumulate in insulation layer and envelope, **which greatly increases the energy consumption of building temperature control and affects the stability of building envelope**

## Hypak™ solutions

is widely applied in

-  Curtain walls
-  Tile roofs
-  Metal roofs
-  Zero energy buildings
-  Cold storage



### Schematic diagram of Hypak™ material

-  Waterproof
-  Breathable
-  Wind resistance
-  Toughness
-  Aging resistance
-  Recyclable

### The material itself has hydrophobicity and ultra-fine fiber network structure

It can be used as an important waterproof underlayment and protective layer in the building envelope, which can help the water vapor diffusion in the envelope while keeping the insulation structure dry, significantly reducing the formation probability of thermal bridge, improving the building insulation capacity and reducing the building energy consumption

### Excellent windproof performance

It can not only effectively eliminate the influence of air convection on the insulation performance of the insulation layer, but also help improve the air tightness of the building, reduce the heat loss and further reduce the building energy consumption

### Convenient construction and easy installation

Meet the use requirements of different building designs

Improve the air tightness of **cold storage**  
Reduce energy consumption of cold storage

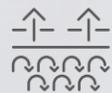
## Challenges faced by cold storage

At present, there are over 100,000 cold storages in China, and the number continues to grow. The internal temperature range of cold storage is generally  $-30\text{ }^{\circ}\text{C}$  ~  $-10\text{ }^{\circ}\text{C}$ , and the temperature difference between the two sides of building envelope reaches about  $60\text{ }^{\circ}\text{C}$ . In order to maintain the performance of cold storage and reduce its energy consumption, the envelope structure shall have good heat insulation and moisture resistance.



### High air tightness

The combination of vapor insulation material and waterproof & breathable material can meet the strict air tightness design requirements of cold storage, reduce the temperature fluctuation in cold storage, reduce the probability of cold bridge, achieve better cold insulation effect and improve building economy



### Vapour barrier and breathability

The water vapor permeation of the vapor insulation material is less than  $1.5\text{ g/m}^2\text{ 24h}$ , which can effectively block the water vapor permeation from the high temperature side of the cold storage to the insulation layer; the Hypak™ water resistive and vapour permeance barriers can realize waterproofing and allow water vapor to be discharged smoothly, keeping the insulation layer dry and avoiding condensation and frost heaving



### Reflected thermal radiation

After processing, Hypak™ material can effectively reflect heat radiation (near infrared reflectivity reaches 90%) and enhance the heat insulation of cold storage building envelope

## Hypak™ application principle

The water vapor of the air always permeates from the high temperature side to the low temperature side. A special air insulation membrane for cold storage is arranged on the high temperature side of the insulation layer, while Hypak™ waterproof & breathable material with strong hydrophobicity and breathability is arranged on the low temperature side, which can not only prevent the water vapor from entering the insulation layer, but also allow the water infiltrating into the envelope to diffuse.

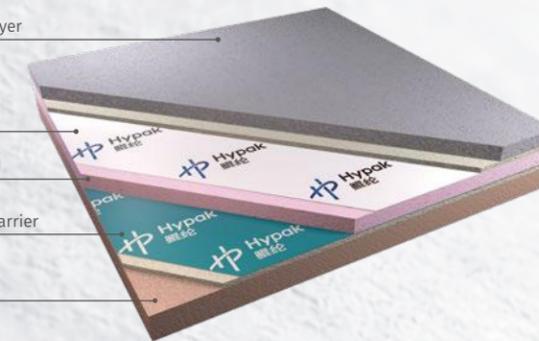
The combination of dredging and blocking can avoid the accumulation of water vapor in the envelope, keep the insulation layer dry, reduce the probability of cold bridge formation and the frost heave damage probability of the insulation layer, improve the insulation capacity of buildings and reduce energy consumption.

Schematic diagram of principle



Schematic diagram of ground structure of cold storage

Steel concrete protective layer  
Hypak™ water resistive and vapour permeance barriers  
Extruded polystyrene board  
Hypak™ reflective vapour barrier  
Base layer



## Effect

- 1 Effectively reduce the temperature fluctuation in the cold storage, create a stable low temperature environment and improve the storage quality
- 2 Reduce the probability of cold bridge formation, reduce cold consumption and refrigeration cost

## "Comfortable protective clothing" for steel/wood structure buildings

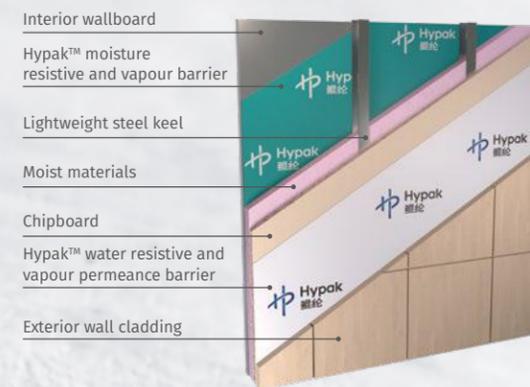


## Hypak™ solution

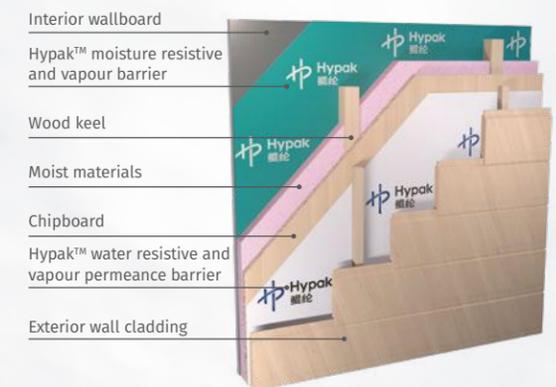
Hypak™ water resistive and vapour permeance barrier covers the outside of building thermal insulation system; together with vapour barrier, it achieves water resistive and vapour permeance, moisture and mold resistance, prolonging service life of buildings and reducing building energy consumption.

### Structure diagram

Lightweight steel structure



Wood structure



## Performance characteristics

### 1 Excellent moisture control system to achieve moisture and mold resistance

Hypak™ water resistive and vapour permeance barrier, with good hydrophobic property, can effectively prevent outdoor leaky rainwater and condensed water from entering, providing a waterproof protective layer for buildings together with other accessories.

The outdoor side of buildings is provided with Hypak™ water resistive and vapour permeance barrier, which can effectively help water vapour in building envelopes to diffuse outward and not gather in thermal insulation layer; at the same time, a vapour barrier is provided at indoor side to prevent water vapour from penetrating into envelope system, keeping the thermal insulation layer dry, and effectively avoiding mold and corrosion etc. caused by water vapour condensation.

### 2 Improve the air tightness and reduce building energy consumption

Hypak™, with excellent windproof capability, which is covered on the outer layer of building envelopes, can improve the air tightness of buildings, reduce the energy loss caused by air convection, giving full play to the thermal insulation effect of the outer wall of lightweight steel structure buildings.

Hypak™, with excellent water vapour evacuation capability, can avoid "cold bridge" in the outer wall of buildings to a great extent, so that the buildings have stronger thermal insulation effect, with building energy consumption reduced.

The advantages of wood structure buildings are more prominent under the background of carbon peaking and carbon neutrality. Modern wood structure buildings are a new form of green building, which has good ecological and environmental benefits in low carbon and energy saving, recycling, garbage reduction, carbon sequestration and storage, etc. Modern wood structure system is often constructed by assembly construction, which can effectively shorten the construction period because of its fast on-site assembly speed. Through the organic combination with concrete structure and steel structure for wood structure buildings, it brings more possibilities for prefabricated buildings, playing an important role in promoting the industrialization of new buildings in China.

Wood is a natural low-carbon building material, which is renewable, recyclable and degradable. However, water vapour is everywhere in the air, which seriously threatens the durability and energy consumption of wooden structures. By taking waterproof and windproof protection measures for buildings, moisture and mold resistance can be achieved to improve the air tightness of buildings, which cannot only greatly increase the durability of buildings, but also improve their energy consumption.

Improve the air tightness and water tightness of non-transparent **curtain wall buildings**

Improve building durability and energy saving effect

Curtain wall is an exterior wall envelope or decorative structure commonly used in modern large and high-rise buildings, which is generally wrapped on the surface of the main structure, has strong wind resistance and earthquake resistance, and is convenient for renewal and maintenance.

In recent years, the output value of China's curtain wall industry has continued to grow, and it is estimated that the output value will increase to RMB 660 billion in 2025.



#### Waterproof

As an important waterproof underlayment, Hypak™ material is laid outside the building insulation layer to help improve the watertightness of the buildings and effectively prevent rainwater from entering the insulation layer



#### Breathable

Hypak™ can evacuate the water vapor entering the insulation layer, reduce the probability of condensation formation, effectively avoid the invasion of water vapor condensation on the buildings, and keep the insulation layer dry for a long time



#### Windproof

With excellent windproof property, Hypak™ can improve the air tightness of the walls, reduce air convection, effectively reduce heat loss and reduce building energy consumption



#### Durable

Hypak™ has excellent aging resistance and wear resistance, which can have the same service life as curtain wall system

## Hypak™ application principle

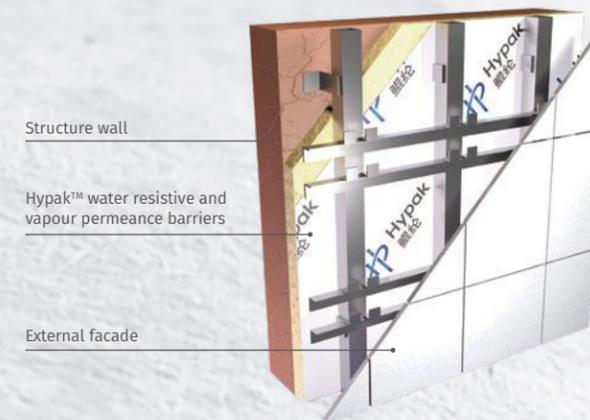
Building insulation is the core link of building energy saving.

In the curtain wall system, Hypak™ water resistive and vapour permeance barriers, as an important waterproof underlayment, covers the outer layer of the insulation layer, which can effectively prevent outdoor rainwater from entering the insulation layer; help the water entering the insulation layer to be emitted to the environment in the

form of water vapor, keep the insulation layer dry, effectively solve waterproof and moisture-proof problems, and improve the insulation capacity of buildings.

With excellent windproof performance, Hypak™ can effectively reduce the negative impact of air convection on the performance of insulation layer and reduce building energy consumption.

### Schematic diagram of structure



## Effect

1 Improve the water tightness of buildings, reduce the probability of cold bridge formation, improve the insulation capacity of buildings and reduce the energy consumption

2 Improve the air tightness of buildings, effectively reduce the heat loss of buildings, and make buildings more energy-saving

Provide excellent watertight and airtight protection for **metal structure buildings**

Control moisture, prevent condensation, and make building energy saving lasting and stable



Metal structure buildings have obvious advantages in environmental protection, energy saving and high efficiency, and have become the mainstream choice of modern industrial buildings. However, the temperature transfer of metal structure is fast, and the water vapor pressure difference caused by indoor and outdoor temperature difference easily makes the water vapor on the high temperature side condense on the surface of low temperature metal structure, forming condensed water, which accumulates in the envelope and insulation layer, causing corrosion of metal structure and greatly reducing the effect of insulation layer over time. Therefore, the envelope system of metal structure buildings should have good functions such as air insulation, waterproof (condensate prevention), ventilation and wind protection.



### Durable waterproof underlayment

Hypak™, durable and corrosion-resistant, is an important waterproof underlayment for metal roofs, which can improve its waterproof ability and resist the invasion of rainwater on roofs



### Control moisture

As a unique “breathable” material, Hypak™ water resistive and vapour permeance barriers can not only provide waterproof function, but also ensure the smooth discharge of water vapor inside the insulation layer, so that the insulation layer keeps dry for a long time, so as to avoid dampness and mold



### Improve air tightness

Hypak™ water resistive and vapour permeance barriers has excellent windproof performance, which can improve air tightness of buildings, reduce heat loss caused by heat convection and reduce building energy consumption

## Hypak™ application principle

Hypak™ water resistive and vapour permeance barriers cover on the insulation layer, and the material itself is hydrophobic, which is an excellent waterproof underlayment, and can isolate the condensed water formed on the inner surface of the upper metal cover plate from invading the insulation layer.

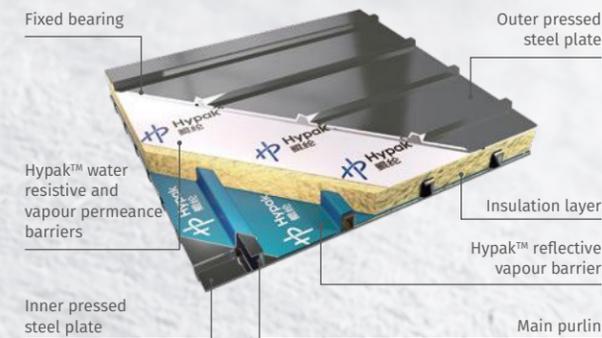
Its excellent breathability performance allows a small part of water entering the insulation layer to be emitted to the

environment in the form of water vapor, so that the insulation layer can keep dry for a long time.

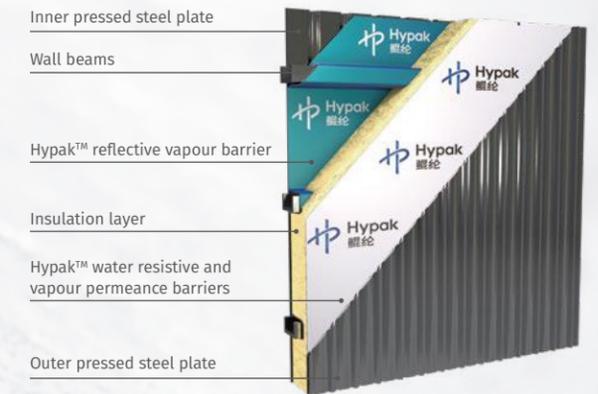
Dry insulation layer can continuously exert insulation ability and reduce building energy consumption. With excellent windproof ability, Hypak™ can improve the air tightness of building envelope, reduce the heat loss caused by air thermal convection and further reduce building energy consumption.

### Schematic diagram of structure

Double laminated steel roof



Double laminated steel wall



## Effect

1 Improve the water tightness of metal structure buildings, so that the water vapor inside the building envelope can be quickly discharged, and the building can be more durable

2 Improve the air tightness of metal structure buildings, reduce building energy consumption and make buildings more energy-saving

## Safety protection

Achieve comfortable internal and external protection



## Challenges faced by protective clothing industry



### An important line of defense for life and health

As an important line of defense to protect the life and health of people engaged in medical and health care, public services, industrial cleaning, oil pollution cleaning, etc., even minor puncture or tear will cause serious consequences



### Poor comfort

Protective clothing made of common materials is more airtight but less breathable, firm but not enough to fit the human bodies, and its wearing comfort is not good, which affects the wearers' range of activities

## Hypak™ solution



The compact structure and tiny pore size can resist aerosols and dust particles, which makes Hypak™ have strong antibacterial ability; Hypak™ has a smooth, lint-free surface, making it less prone to contamination; Hypak™ does not produce pollutants by itself, which reduces the possibility of secondary pollution

Hypak™ has slender fibers, and its product is breathable, waterproof, puncture-resistant and tear-resistant; This can achieve a balance of strong protection and wearing comfort

Hypak™ is stable and resistant to all types of acid and alkali corrosion, and can withstand all kinds of chemical threats or hazards from clean room to hazardous material cleaning

Hypak™ is highly opaque and anti-static, which makes it compatible with other personal protective equipment such as goggles, gloves, face masks, etc.; it is comfortable to wear and free to move; and the waste disposal cost is low

# Industrial innovation

High efficiency, low consumption,  
energy saving and environmentally friendly

is widely applied in



Fine powder



Active packaging



Outdoor advertising



Packaging of precision instruments



Schematic diagram  
of Hypak™ material



Waterproof



Breathable



Toughness



Dustproof



Smooth



Recyclable

Provide high-performance **packaging**  
for different application scenarios



## Main challenges faced by various packaging application scenarios



Common packaging materials **cannot achieve the balance between waterproof and breathability performance**, which not only affects the packaging and transportation efficiency, but also easily leads to leakage due to weak waterproof performance and then **affects the storage period**



Common packaging materials will produce particles, scratches, static and other factors, which are **easy to damage the performance and quality of precision electronic products**



Common packaging protection materials are easily **unstable** or less effectively blocking the paint aerosols and dust by **affecting chemical substances, further effecting the working life and service time of industrial robots, automobiles and other mechanical equipment**



Industrial designs and precious works of art are **extremely vulnerable to ultraviolet rays, scratches, mold, dust, water vapor or other condensates**, further damaging their value



## Hypak™ solutions

Schematic diagram  
of Hypak™ material



Waterproof



Breathable



Wind resistance



Toughness



Aging resistance



Recyclable

### High balance of breathability performance and water resistance

It not only improves the filling efficiency of various products, but also keeps the bag dry and stable for a long time. It is an excellent packaging material for electronic desiccant, medical desiccant, container desiccant etc.

### Fine material fiber structure

It can efficiently block aerosol and particle products, provide high-performance packaging for products to realize high-efficiency protection. It is a best choice of industrial robot protective cover, an automobile protective cover, etc.

### Toughness, smoothness, no debris, anti-static electricity and high cleanliness

It is the best choice for packaging materials of sensitive electronic components

### Excellent diffuse reflection performance

It can reflect most visible light, part of ultraviolet light and infrared light, and is an excellent solar radiation thermal barrier

## Desiccant packaging solution

Applicable to most application scenarios

The control of moisture is closely related to the yield of products. Excessive moisture in packaging bags makes food perishable, electronic products oxidized, and clothes mouldy. The use of desiccant can avoid defective products caused by excessive moisture and improve the storage life of products. Common desiccant materials, such as calcium chloride, silica gel, montmorillonite, etc., will become gelatinous or dissolved after absorbing water, so higher requirements are required for packaging materials.

Hypak™ is smooth in appearance and highly clean, and characterized with good water resistive and vapour permeance, high strength, fold-resistance, tear resistance, static prevention and high barrier, which is an ideal choice of desiccant package material.



## Hypak™ solution



### Excellent waterproof permeability performance

High moisture absorption rate and low leakage, with significant improvement of moisture resistance



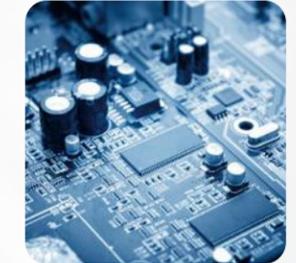
### Easy to clean

Smooth surface, anti-static and less contaminated



### Applicable to most application scenarios

High strength, tear resistance and excellent break resistance, and easy machining



### High chemical stability

100% polyethylene made, good chemical stability, and compatibility with most products



### Compatible with printing methods

Good color development, solid coloring, legible handwriting, and traceable product information



### Green environmental protection

Pure ingredient, non-toxic and non-irritating, and easy to recycle; effectively reduce resource waste

## Usage scenarios of Hypak™ packaged desiccant

### are widely applied in

containers, electronic products, mechanical products, high-grade clothing, optical products, household appliances, medical products, etc.

### Hypak™ characteristics



Waterproof



Air permeable



Dust proof



Tear resistant



Environmentally friendly



Easy machining



Smooth



Easy printing

## Hypak™ agricultural mulch helps agriculture to increase production and efficiency

Mulch is a vital agronomic measure in agricultural production. Hypak® agricultural mulch has played a prominent role in regulating ground temperature, conserving water and fertilizer, greatly shortening the cultivation time of crops, saving agricultural water, improving the ability to resist agricultural disasters, and ensuring the increase and stability of crops.

## Hypak™ solution



### Earlier time to market

Hypak™ agricultural mulch can improve soil temperature and inhibit drastic changes of soil temperature. It also can improve the utilization rate of light energy, increase the light intensity of parts bearing fruits, and promote the early coloring and marketing of fruits

### A sweeter taste

The light diffuse reflection of Hypak™ agricultural mulch can effectively change the light conditions of crops during growth period, improve the photosynthesis intensity of crops, increase the photosynthetic yield and the accumulation of organic matters, and improve the sugar content of fruits

### Better appearance

The diffuse reflection performance of Hypak™ agricultural mulch can make the light reflect evenly to fruits, improve the uneven coloring of fruits and enhance the economic benefits of fruit farmers

### Healthier growing environment

Healthier growth environment layer plays a protective role, preventing soil hardening caused by wind, making soil hardening caused by soil conservation and making soil conservation root system grow



Hypak™ agricultural mulch can inhibit growth of weeds and reduce harm of diseases and insect pests. The reflected light also disturbs the flight of pests. At the same time, the dense structure of Hypak™ can prevent the way of eggs hatching in the soil, thus achieving the effect of repelling pests. Therefore, Hypak™ agricultural mulch provides a healthier growth environment for fruits and vegetables, helps growers to increase the total output of fruits and vegetables, and realizes higher planting income

# Creative life

Let imagination  
play freely



As a special new material, Hypak™ has brought new inspiration to designers in different industries. The unique material also provides a basis for free release of inspiration and brings new experience to users



### Unique texture and quality

It brings special imagination to the design of various printed materials and handcrafts, allowing designers to give full play to it



### Excellent color adhesion and high diffuse reflection

Hypak™ material is compatible with most printing methods, and its multi-layer fiber web structure can reflect most visible light, which makes graphics more vivid and advertisements more long-lasting



### Excellent weather resistance and durability

It has super folding resistance and adapts to ± 50 C temperature environment; it is resistant to ultraviolet ray, waterproof and anti-corrosion, with long service life



### High chemical stability

Hypak™ is made of 100% polyethylene, which has high chemical stability and does not contain any harmful substances. The material is light and waterproof, strong and durable, tear-resistant and puncture-resistant, and can keep information content undamaged for a long time, making it the preferred material for various wristband products



### Balanced performance, suitable for a variety of use scenarios

Hypak™ achieves a high balance in waterproof, breathable, light weight and high strength. It has strong weather resistance, and is not affected by extreme weather conditions; the material is also smooth and flat, and the content can be printed clearly, therefore Hypak™ becomes an ideal material for labeling



### Environmentally friendly and recyclable

Hypak™ material itself is non-toxic and odor free, and the finished products can be recycled

Hypak™ now has been widely used in various fields such as household products, fashion products, creative products, commercial promotions and gifts, and special printed materials and so on.



## Kingwills Advanced Materials Co., Ltd.

Kingwills™ is committed to becoming the world's most creative material technology enterprise, create sustainable solutions for a better and happy life for people.

The founding team members of Kingwills™ all graduated from top universities at home and abroad, have many years of working and management experience in Fortune 500 companies. They advocate innovation-led and people-oriented corporate culture. The company attaches great importance to R&D investment and technical talent reserve. We have established a high-level scientific research team composed of doctoral and master talents in chemical engineering and technology, organic chemistry, polymer materials and other majors. The team provides a solid technical guarantee for the continuous R&D and innovation of products, the continuous optimization of existing product processes and quality improvement. At present, Kingwills™ has accumulated a wealth of patents and proprietary technologies, and has obvious core competitive advantages.

In addition, the company has carried out strategic cooperation with well-known research institutions and universities at home and abroad, such as Max Planck Institute and Zhejiang University, to continuously promote more metamaterial research and development and technological achievements transformation, and realize the sustainable development of the company.

Kingwills' s commercialized plant has gone into operation successfully, which has injected fresh vitality into the innovation of domestic materials science and technology and the high-quality development of new materials industry.

### In 2014

Shanghai Kingwills Advanced Materials Co., Ltd. was established

### In 2022

the large-scale production base of Kingwills™ Industrial Park has been put into operation in Nantong, Jiangsu

 **“Nanofiber+ flashspun”**  
create the future material world

## Development Path