SILICA AEROGEL TECHNOLOGY

气凝胶隔热保温涂料

THERMAL INSULATION COATING

隔热保温 | 超轻超薄 | 防火阻燃

Thermal Insulation · Ultra-light & Ultra-thin · Fire Retardant

源自航天科技的气凝胶保温材料，一道涂层解决建筑与工业的隔热难题。

Aerogel born in aerospace — one coating for every thermal challenge.
Engineered for buildings and industry alike.



源自航天科技
Aerospace-derived

高效节能
Energy efficient

持久耐用
Long-lasting

绿色环保
Eco-friendly

什么是
气凝胶隔热保温涂料

What Is Aerogel Thermal Insulation Coating?





二氧化硅气凝胶纳米多孔结构
Silica aerogel nano-porous structure

气凝胶隔热保温涂料是一种以**二氧化硅气凝胶**为核心材料的高性能保温涂料。气凝胶被誉为“改变世界的材料”，具有纳米级多孔结构，可有效阻隔热量传导与对流，提供卓越的保温效果，同时具备防水、防腐、耐候、环保等优异性能。

A high-performance insulation coating built on a silica aerogel core. Hailed as “the material that changes the world,” aerogel carries a nano-porous structure that blocks both conduction and convection — delivering outstanding thermal performance together with water resistance, corrosion protection, weathering durability and environmental safety.

应用领域 APPLICATIONS

建筑墙体 Building Walls
提升建筑节能效果，打造舒适室内环境
Improves building energy efficiency and indoor comfort

屋面系统 Roof Systems
有效反射热量，降低室内温度
Reflects heat effectively and lowers indoor temperature

管道设备 Pipes & Equipment
减少热损失，提升运行效率
Cuts heat loss and improves operating efficiency

储罐容器 Tanks & Vessels
保持温度稳定，降低能耗
Maintains stable temperature and reduces energy use

集装箱等 Containers
防热隔热，保护货物安全
Blocks heat and protects cargo

高效保温 Low thermal conductivity
节能环保 Energy saving, eco-safe
防水防腐 Water & corrosion resistant
耐候抗老化 Weather & ageing resistant

MECHANISM 01 · 02

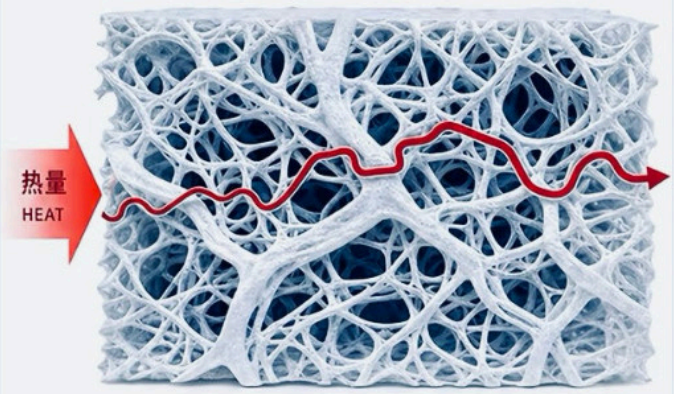
三重隔热机理

科学管理热量 | Engineering Heat, Scientifically

1 阻隔热传导 Blocks Heat Conduction

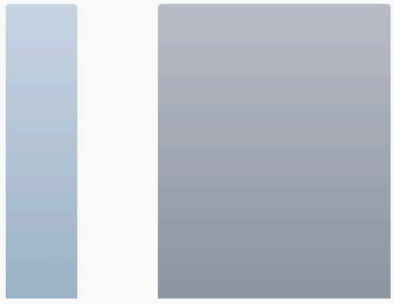
纳米多孔网络结构，延长热传路径，降低固体传热

A nano-porous network lengthens the heat path and suppresses solid conduction



厚度对比（相同隔热效果）

Thickness for equal insulation performance



2–5 mm	20–30 mm
气凝胶涂层	传统隔热材料

柱高 = 相同隔热效果　柱宽 = 所需厚度 · Bar height = equal performance, bar width = required thickness

无限路径效应 Infinite Path Effect

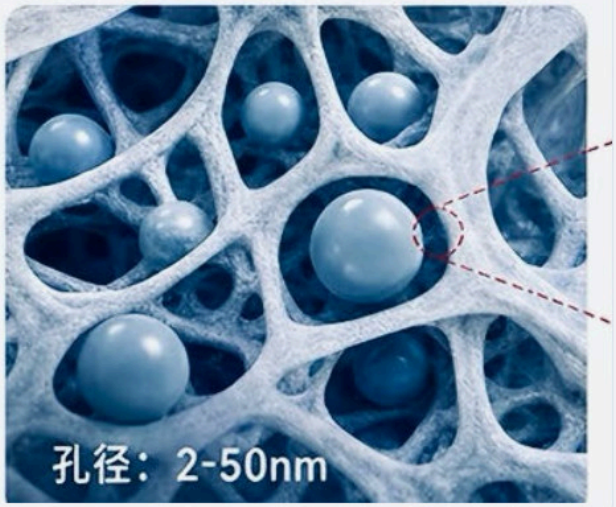
纳米级孔隙和曲折的三维网络结构，使热量在固体中的传导路径无限延长、反复迂回，从而显著降低固体热传导系数。

Nano-scale pores and a tortuous 3D network stretch the conduction path endlessly, sharply reducing solid-state thermal conductivity.

2 抑制热对流 Suppresses Heat Convection

纳米孔隙中封存气体分子，消除对流传热

Gas molecules are trapped inside nano-pores, eliminating convection



气体分子特性对比（以空气为例）

Gas molecule characteristics — air as example

气体分子直径 Molecular diameter		平均自由程 Mean free path
O_2 / N_2	<	
~0.36 nm		~70 nm

分子直径 ≪ 平均自由程

气体分子在孔隙中碰撞孔壁的概率远大于相互碰撞

Molecules hit pore walls far more often than they hit each other

近真空状态 Near-Vacuum State

气体分子与孔壁频繁碰撞，动能被不断消耗，几乎无法携带能量进行定向移动，从而有效抑制气体对流，达到近真空的隔热效果。

Frequent pore-wall collisions drain molecular kinetic energy and block directional heat flow — a near-vacuum effect.

MECHANISM 03 · SYNERGY

三重协同，极致隔热

反射热辐射 • 三效合一 | Three Mechanisms, One Coating

3 反射热辐射 Reflects Radiation

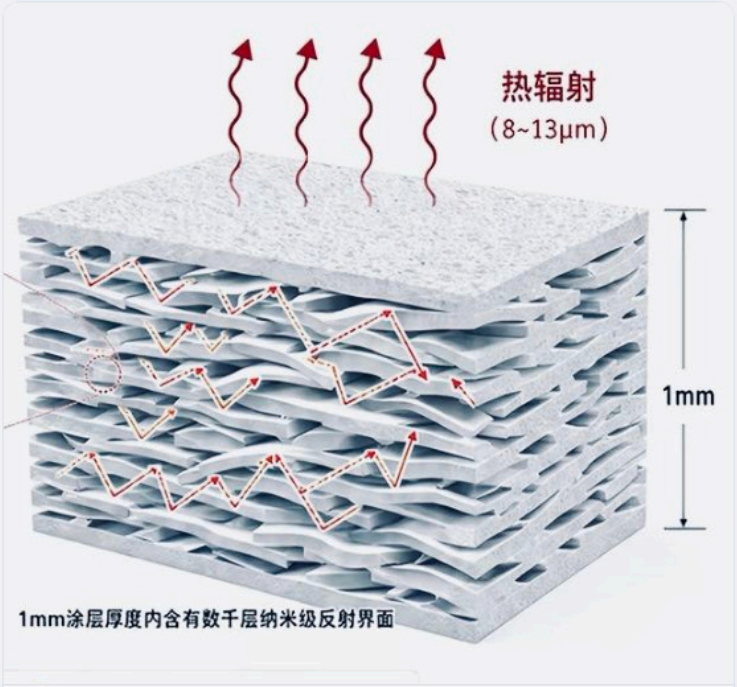
多重反射热辐射，阻止热量向外太空散失

Multiple internal reflections stop heat from escaping to space

涂层中纳米级孔隙结构内壁具有高红外反射率，可对物体自身发出的中远红外热辐射进行多次反射和折返，形成“光学迷宫效应”，显著降低通过大气窗口（8–13μm）的热辐射向外太空的散失。

Pore walls carry a high infrared reflectance, bouncing mid- and far-infrared radiation back and forth to create an “optical labyrinth” that sharply cuts radiative loss through the atmospheric window.

大气窗口（8–13 μm）
Atmospheric window
地球表面物体主要通过该波段向太空辐射热量，
本涂层针对性抑制此波段热辐射散失。
Objects on Earth shed heat to space mainly in this band — the coating targets exactly this loss.

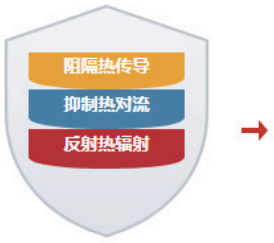


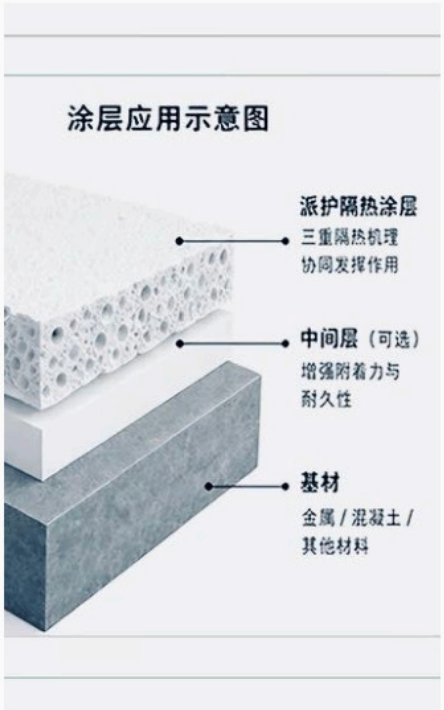
协同效应 • 层层阻断 How the three work together

三重隔热机理协同作用，层层阻断热量传递路径，最大限度减少热量的吸收、传导和辐射，实现卓越的隔热性能与能效提升。

The three mechanisms block heat at every stage — absorption, conduction and radiation.

1. **阻隔热传导** Conduction blocked
   Nano-porous network lowers solid-state transfer
2. **抑制热对流** Convection suppressed
   Pores below the air mean free path stop gas flow
3. **反射热辐射** Radiation reflected
   Multiple reflections cut radiative loss





Aerogel insulation layer · intermediate layer (optional) · substrate

显著降温
Significant cooling
降低表面温度 **15–40°C**
Cuts surface temp. by 15–40 °C
* 具体效果因环境而异 / Results vary with site conditions

节能增效
Energy savings
减少空调与设备能耗
Cuts HVAC and equipment load

绿色环保
Eco-friendly
无 VOC，低碳环保
VOC-free, low-carbon

持久耐用
Long-lasting
抗老化、耐候性优异
Anti-ageing, weather resistant

哪里需要保温，哪里就有气凝胶



建筑外墙
EXTERIOR WALLS

气凝胶涂料涂覆于建筑外墙，形成高效保温层，有效阻隔热量传递，冬暖夏凉，降低建筑能耗，提升居住舒适度。

Applied to exterior walls, the coating forms a highly efficient insulation layer that blocks heat transfer — cooler in summer, warmer in winter, lower energy bills, better comfort.

New build · Retrofit · Concrete · Render · Masonry



内墙保温
INTERIOR WALLS

气凝胶涂料应用于内墙表面，在有限空间内实现高效保温，减少室内热量流失，提升室内温度稳定性与舒适度。

On interior surfaces it delivers high insulation performance within limited space, reducing heat loss and stabilising indoor temperature.

Thin profile · No cavity needed · Gypsum · Masonry



屋顶隔热
ROOF INSULATION

气凝胶涂料涂覆于屋顶表面，反射太阳辐射热，降低屋面温度，减少室内热增量，延长屋顶寿命，节能环保。

On roofs it reflects solar radiation, lowers surface temperature, reduces heat gain into the building and extends roof service life.

Reflective · Exposed surface · Flat · Metal · Tiled

工业场景 • 高温设备与金属外壳



工业管道
INDUSTRIAL PIPING

适用于蒸汽、热水、导热油、工艺气体等管道的保温隔热，有效减少热量损失，降低能耗，提升系统运行效率。

For steam, hot water, thermal oil and process gas lines — cutting heat loss and energy use while improving system efficiency.

Steam · Hot water · Thermal oil · Process gas



储罐 / 罐体
TANKS & VESSELS

适用于原油、化工品、LNG 等储罐及罐体设备的保温保护，降低温度波动，防止结露与腐蚀，保障安全与工艺稳定。

For crude oil, chemical and LNG storage — reducing temperature swings, preventing condensation and corrosion, safeguarding process stability.

Crude oil · Chemicals · LNG · Anti-condensation



集装箱 / 金属柜体
CONTAINERS & METAL CABINETS

适用于集装箱、设备柜体、配电柜等金属外壳的隔热保温，隔绝外界高温 / 低温影响，保护内部设备，延长使用寿命。

For containers, equipment enclosures and switchgear cabinets — shielding internals from external heat and cold, extending service life.

Shipping container · Switchgear · Equipment cabinet

超强隔热
Superior insulation
导热系数低

轻薄高效
Thin & efficient
节省空间与能耗

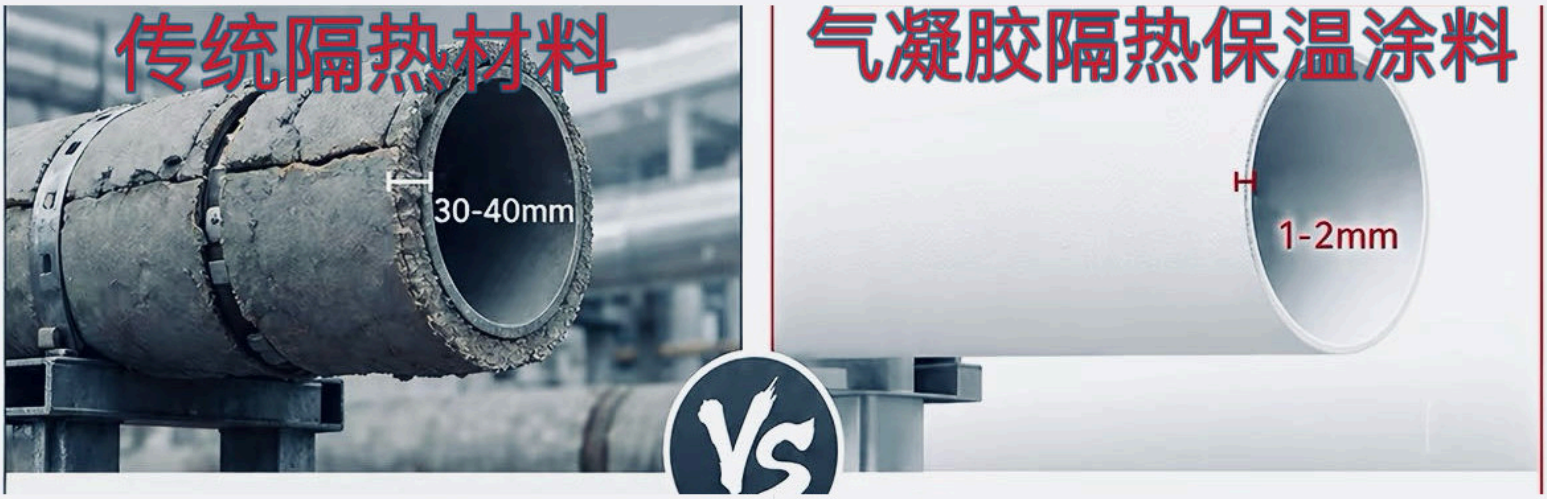
防水防腐
Water & corrosion resistant
保护基材更耐久

施工便捷
Easy to apply
适用多种基材

技术参数一览

参数项目 PARAMETER	参数值 VALUE
产品名称 PRODUCT NAME	气凝胶隔热保温涂料 Aerogel Thermal Insulation Coating
品牌 BRAND	屋顶博士 Manufacturer brand
颜色 COLOUR	白色 White
形态 FORM	水性粘稠浆料 Water-based viscous paste
导热系数 THERMAL CONDUCTIVITY	**0.035 W/(m·K)** Value per factory test report
防火等级 FIRE RATING	**A2** 级 · 建筑款　**A1** 级 · 工业款 Building Class A2 · Industrial Class A1 · non-combustible
干膜厚度 DRY FILM THICKNESS	1–2 mm (可增加 / can be increased)
参考用量 COVERAGE	约 1 L/m² / mm (approx.) 1 litre covers 1 m² at 1 mm dry film
适用温度 SERVICE TEMPERATURE	−20 ℃ ~ +120 ℃ Continuous service range
干燥时间 DRYING TIME	表干约 2–4 小时 Surface dry in approx. 2–4 hours
施工方式 APPLICATION	喷涂 / 辊涂 / 刷涂 Spray · roller · brush
保存方法 STORAGE	5–35 ℃ 阴凉干燥密封 Cool, dry, sealed — 5 to 35 °C
保质期 SHELF LIFE	36 个月 36 months in unopened container
环保标准 ENVIRONMENTAL	无甲醛、无苯类、水性环保 Formaldehyde-free · benzene-free · water-based

ⓘ 以上数据基于出厂检验报告，实际性能受基材、施工厚度与环境条件影响。 Values based on factory test reports. Actual performance depends on substrate, film thickness and site conditions.



厚且笨重
厚度 30–40 mm，占用空间大
Thick and heavy — 30–40 mm, eats up space

超薄高效
厚度仅 1–2 mm，节省空间
Ultra-thin — just 1–2 mm, saves space

安装复杂
需裁切包裹，多道工序，耗时耗力
Complex installation — cutting, wrapping, multiple steps

施工简单
喷涂 / 辊涂即可，施工便捷，省时省力
Simple application — spray or roll, fast and easy

存在缝隙
接口多，易产生缝隙，影响保温效果
Joints and gaps — many seams weaken performance

无缝一体
整体涂覆，无接缝，保温效果更稳定
Seamless — one continuous coating, stable performance

重量大
材料密度高，增加结构负荷
Heavy — high density adds structural load

重量轻
超轻涂层，几乎不增加负荷
Lightweight — adds almost no load

防火等级 B 级
可燃，防火性能一般
Fire Class B — combustible, limited fire performance

防火等级 A1–A2 级
不燃材料，建筑款 A2 / 工业款 A1
Fire Class A1–A2 — non-combustible, superior performance

可能含有甲醛
部分材料含有甲醛等有害物质
May contain formaldehyde — some materials release VOCs

不含甲醛
环保无害，安全健康
Formaldehyde-free — safe and non-toxic

施工简单，一学就会

1



基层处理
SURFACE PREPARATION

- ☑ 基面应平整、坚实、干燥、无浮尘
  Surface must be flat, sound, dry and dust-free
- ☑ 清除油污、灰尘等杂物
  Remove oil, grease, dust and debris

2



涂料准备
COATING PREPARATION

- ☑ 使用前充分搅拌均匀
  Stir thoroughly before use
- ☑ 推荐使用电动搅拌器，搅拌 3–5 分钟
  Mix with a power stirrer for 3–5 minutes

3



涂刷施工
APPLICATION

- ☑ 喷涂、辊涂或刷涂均可
  Spray, roll or brush — all suitable
- ☑ 推荐厚度 1–2 mm，可分 2–3 遍涂刷
  1–2 mm total, applied in 2–3 coats
- ☑ 每遍间隔约 4 小时，待前遍表干后再涂下一遍
  Allow about 4 h between coats; recoat once surface-dry

施工条件
APPLICATION CONDITIONS

环境温度 5–35 °C，通风干燥
Ambient 5–35 °C, dry and well ventilated

避免雨天、大风天气施工
Avoid application in rain or high wind