砂岩环保吸音板

Environmental-Friendly Acoustic SandPanel

专利技术·德国品质

Patented Technology · German Quality

砂岩板聚合制造工艺　Manufacturing Process of the SandPanel

砂岩板原料精选内蒙古高原天然砂，利用德国特殊工艺，将一种无机硅基溶剂，均匀且极薄地施涂于全部砂粒表面（砂粒的主要成分是二氧化硅），使砂粒外层之间发生一种溶融再固化反应，由此，砂粒就像被焊接一样聚合在一起。因为每颗砂粒的微观形状是不规则且独一无二的，聚合积压在一起时，砂粒之间天然地形成了大量的、不规则的、相互连通的微小孔隙。在聚合工艺中，砂粒粒径与聚合方式均可精确地调控，进而确定了内部孔隙的大小及排列方式，由此生产出各种不同流阻与吸声特性的砂岩板。聚合工艺生产的砂岩板强度高、防火、防潮、抗冻、耐老化，而且工艺中无胶粘剂，砂岩板也无任何有机挥发物，是绿色环保建筑吸声材料。

The acoustic SandPanel is made of selected nature sands from Inner Mongolia plateau using a special German technology. The inorganic and silicon-based solvent is thinly and evenly applied to the surface of sand particles(whose main ingredient is silica), which causes the outer surface of sands to melt and then solidified between each other, in this way, sands are be aggregated together, just as they were welded together. Because the shape of each sand particle is irregular and unique, when aggregated together, a large number of irregular and interconnected micro pores will be naturally formed. In the aggregating process, to precisely control the sand particle size and aggregation procedure, which could determine both the pore patterns and its arrangements represented by air flow resistance, we can achieve SandPanel of variety sound absorption characteristics. Manufactured by the aggregation technology, the SandPanel inherently have high strength and are fire-, moisture-, frost-and aging-resistance. Most of all, no adhesive is used in the process, so there is no volatile organic compounds in the panels. SandPanel is green environmental-friendly acoustic material.

砂岩板主要特性　Main features of the SandPanel

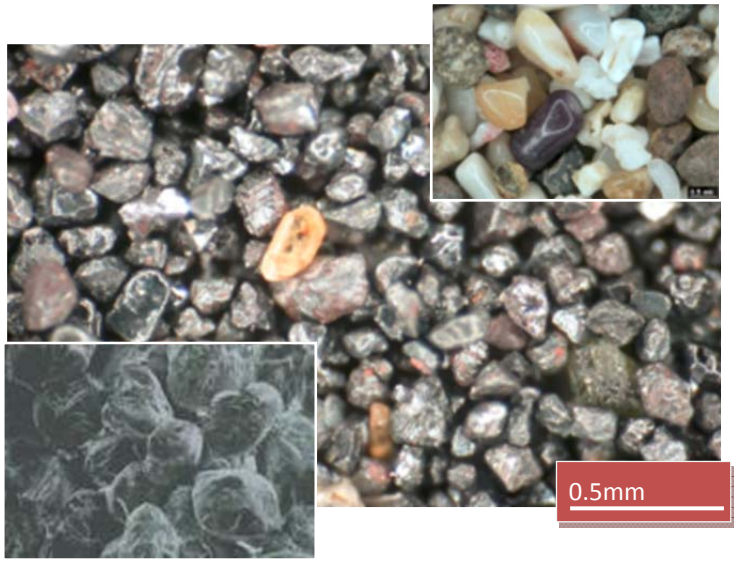
- **防　火**：燃烧性能为 A 级，可广泛应用于各种场所
- **吸　声**：高、中、低吸声频率特性可调，适用于各种吸声要求
- **环　保**：总挥发物（TVOC）为 0.062，远低于国家标准≤0.5 的要求
- **防　潮**：湿胀率仅 0.16%，防潮性能优异
- **抗　冻**：经冻融循环试验检测，无起层和龟裂等破坏现象
- **抗冲击**：抗冲击强度优于同厚度水泥纤维板
- **耐老化**：抗紫外线试验结果显示，性能保持不变
- **装　饰**：独特的砂岩质感，简约质朴的风格

- **Fire-resistance:** A-Class, which can be widely used in all kind of buildings.
- **Sound-absorbing**：Frequency characteristics can be adjusted to fulfill various sound-absorbing requirement.
- **Environmental-friendly**：By testing, total volatile organic compound（TVOC）is 0.062, much lower than the national standard which is ≤0.5.
- **Moisture-resistance**：Swell rate is only 0.16%，high performance of moisture-resistance.
- **Frost-resistance**：No stratum, cracking or and other wreck phenomenon after freeze-thaw cycle test.
- **Pound-resistance**：performance of pound-resistance is better than the same thickness cement fiberboard.
- **Aging-resistance**：The quality won't change in ultraviolet exposure.
- **Decoration:** Unique sand stone pattern, simple and pure.

砂岩板吸声原理　The sound-absorbing principle of the SandPanel

砂岩板内部有许多相互连通的形状各异的微小细孔，当声音入射到砂岩板表面时，声波会透入砂岩板内部，在细孔中传播时，由于空气运动产生的粘滞性和摩擦阻力作用，使声能逐渐转化为热能而消耗，由此产生吸声作用。砂岩板吸声的高、中、低频率特性与砂粒间细孔的大小、数量、构造形式等密切相关，通过对这些细孔的调控，就实现了吸声频率特性可调的功能。

流阻是空气在材料孔隙中通过的阻力，是衡量砂岩板吸声性能的重要性能指标。砂粒稀疏、孔隙通畅则流阻较小；砂粒密实、孔隙迂回曲折则流阻比较大。适当的流阻可调控砂岩板中、高频的吸声性能，板后空腔可调控低频吸声性能，通过不同的流阻与空腔的组合，可实现高、中、低的不同吸声设计要求。在实际工程中，结合声学设计要求“对症下药”地选用砂岩板，将起到事半功倍的效果。



There are many interconnected tiny pores with different shapes inside the acoustic SandPanel. When sound wave reaches the surface of the panels, it will run deeply inside and propagate among the pores. Due to the viscous resistance and friction generated by the movement of air particles, sound energy will gradually be consumed into thermal energy and results in sound-absorbing. The structure of the pores between sand particles determine the acoustic frequency performances, so by adjusting the sizes, quantities and forms of these pores, we can control the sound-absorbing frequency characteristics.

The air flow-resistance is the resistant force when air passes through materials, which is an important parameter indicating sound-absorbing performance of the panel. The air flow resistance will be smaller when the sands are sparse, bigger when the sands are dense or pores are tortuous. Proper flow-resistance can adjust the sound-absorbing performance in mid- and high- frequency of the sand panel, while cavity behind the panel can adjust the low frequency. By combining different flow-resistance and cavity, sound-absorbing requirements in both high-, mid- and low-frequency can be fulfilled. In real projects, choosing SandPanel to meet the acoustic design requirements, can make the project much better and easier.

应用项目案例 Acoustic SandPanel applications

激光巨幕影厅 • 砂岩吸声墙面
Laser-max cinema • Sound-absorbing wall

数字立体声影厅 • 砂岩吸声墙面
Digital stereo cinema • Sound-absorbing wall

报告厅 • 无缝喷砂装饰吸声墙面

Auditorium · Sound-absorbing wall of fine sand seamless spraying

家庭影院 • 砂岩吸声墙面

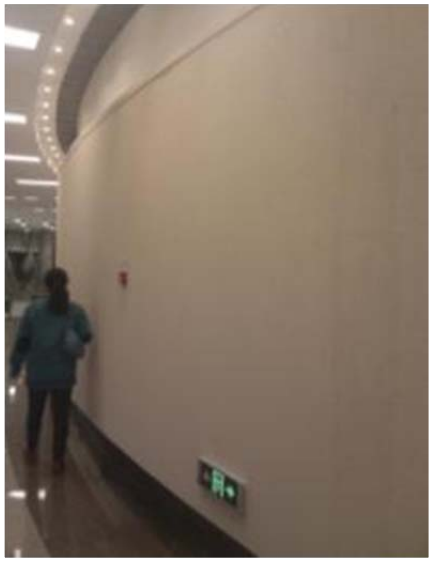
Home theater • Sound-absorbing wall

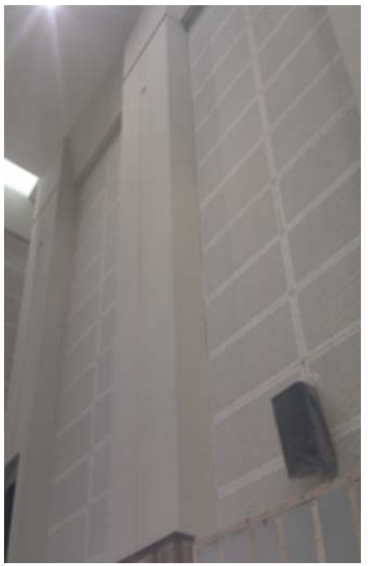
- 剧场、剧院、音乐厅
  Theater, concer hall
- 多功能厅、会议室、视听室
  Multi-purpose hall, conference room, audio-visual room
- 体育场馆、健身中心
  Stadium, fitness center
- 实验室、检测室
  Laboratory , testing room
- 演播室、录音室、排练厅
  Studio, recording studio, rehearsal hall
- 候车（机）室
  Railway (terminal) station house
- 酒店大堂、营业厅
  Hotel lobby, business hall
- 需要降噪的厂房 或车间
  Factory or workshop that need noise reduction









安装工艺 Installation Process

龙骨安装与调平
Install frames and level it

（轻钢龙骨或木龙骨均可）
（Either metal frame or wood keel）

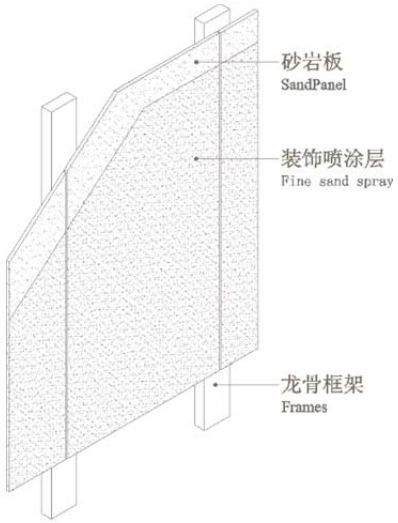
砂岩板与龙骨钉接
Nail the sand panels on frames

（采用螺钉或射钉均可）
（Either bolts or nails）

饰面处理（三种）
Surface finishing(3 kinds)

①	②	③
裸板 饰面 Bare panel finishing	面层留缝 喷砂饰面 Fine sand spraying with seams as finishing	板缝嵌缝抹砂找平 + 面层无缝喷砂饰面 Seams filling with fine sand and spraying seamless as finishing

◆ 安装构造示意图
Diagrams of the installation

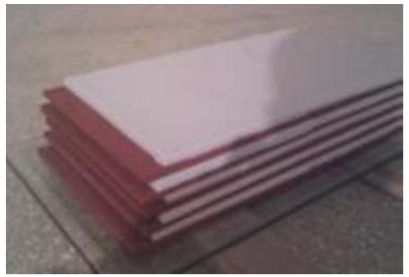


◆ 砂岩板龙骨框架
Keels and frames of the SandPanel

◆ 砂岩板安装过程
SandPanel installation process

◆ 砂岩板面层喷砂
Sand spraying

◆ 砂岩板切割
SandPanel cutting



◆ 砂岩板后附吸声棉，具体选型需结合声学设计要求而定
Add sound-absorbing wool behind the SandPanel, the specific selection will be set according to acoustics design requirements

物理力学性能　Physical and mechanical

常用规格 Universal size mm	密度 Density g/cm³	燃烧性能 Non combustible	环保（TVOC） Environmentally friendship ≤mg/m²·h	抗压强度 Pressure strength ≥MPa	劈裂抗拉强度 Splitting and tensile strength ≥MPa	抗折强度 Folding strength ≥MPa	抗冲击强度 Pounding strength ≥KJ/m²	湿胀率 Swell rate ≤%	握螺钉力 Screw holding ≥N	抗紫外线 Ultraviolet resistance %	抗冻性（25 次冻融循环）Prost resistance (25 times freeze-thaw cycle test)
600×300 ×6	1.5～1.7	A	0.062	29.1	4.44	7.4～24.7	5.2	0.16	690	99	无起层、龟裂等破坏现象 No stratum, cracking or other wreck phenomenon
		GB8624	HJ571	GB/T50081	GB/T50081	GB/T7019	GB/T7019	GB/T7019	GB/T17657	GB/T16422.3	GB/T7019

注：燃烧性能由公安部天津消防研究所检测中心和国家建筑工程质量监督检验中心测定，环保性能与物理性能由国家建筑材料测试中心测定。

Note: Combustibility has passed through tests by both Tianjin Fire Research and Testing Center of the ministry of public safety and the National Construction Engineering Quality Supervision and Inspection Center.
The environmentally friendship and physical performances are tested by the National Building Materials Test Center.

常用构造吸声性能　Absorption properties of common constructions

型号 Type	流阻 Air flow resistance/N·s·m^{-3}	构造简述 Construction		吸声系数（混响室法） Sound-absorbing coefficient(reverberation room method)																	NRC	检测机构 Test institute
		构造 Structure	空腔 Cavity /mm	100	125	160	200	250	315	400	500	630	800	1K	1.25K	1.6K	2K	2.5K	3.15K	4K	5K		
SYB-H01（高频型）(High frequency)	400～600	基板后贴 10mm 厚吸声棉 10mm wool behind the panel	10	0.02	0.02	0.03	0.11	0.11	0.19	0.29	0.32	0.49	0.52	0.64	0.68	0.92	0.96	0.98	0.96	0.85	0.82	0.50	清华大学建筑环境检测中心测定 Tested by Building environment test center, Tsinghua University
		基板后贴 30mm 厚吸声棉 30mm wool behind the panel	10	0.08	0.11	0.10	0.31	0.41	0.66	0.76	0.90	0.96	0.97	0.96	0.94	0.95	0.96	0.88	0.88	0.80	0.91	0.80	
		基板后贴 50mm 厚吸声棉 50mm wool behind the panel	10	0.11	0.23	0.38	0.67	0.62	0.86	0.95	0.97	0.96	0.97	0.99	0.95	0.96	0.89	0.87	0.87	0.89	0.89	0.90	
		基板后贴 10mm 厚吸声棉 10mm wool behind the panel	50	0.05	0.07	0.14	0.29	0.34	0.52	0.81	0.92	0.96	0.94	0.94	0.86	0.84	0.79	0.74	0.76	0.76	0.76	0.75	
SYB-M01（中频型）(Mid frequency)	800～1400	基板后贴 10mm 厚吸声棉 10mm wool behind the panel	50	0.12	0.15	0.31	0.42	0.65	0.62	0.78	0.79	0.73	0.71	0.63	0.59	0.57	0.60	0.62	0.63	0.55	0.67	0.65	
			100	0.22	0.30	0.26	0.49	0.76	0.68	0.81	0.80	0.78	0.72	0.70	0.59	0.64	0.73	0.68	0.70	0.72	0.68	0.70	
			200	0.24	0.34	0.29	0.61	0.85	0.67	0.90	0.87	0.74	0.67	0.65	0.53	0.62	0.66	0.63	0.71	0.68	0.66	0.70	
		基板后贴 50mm 厚吸声棉 50mm wool behind the panel	50	0.18	0.34	0.38	0.67	0.79	0.67	0.85	0.81	0.72	0.70	0.63	0.53	0.54	0.57	0.55	0.55	0.57	0.55	0.65	
			100	0.25	0.44	0.47	0.75	0.73	0.80	0.87	0.77	0.70	0.63	0.55	0.56	0.61	0.56	0.58	0.59	0.57	0.53	0.70	
			200	0.36	0.47	0.46	0.65	0.64	0.68	0.71	0.84	0.91	0.80	0.75	0.71	0.74	0.73	0.67	0.69	0.65	0.66	0.75	
SYB-L01（低频型）(Low frequency)	2000～3000	基板后无吸声棉 No wool behind the panel	50	0.07	0.27	0.34	0.55	0.49	0.36	0.32	0.23	0.16	0.13	0.09	0.09	0.14	0.17	0.21	0.24	0.32	0.4	0.20	
			100	0.11	0.28	0.47	0.56	0.36	0.33	0.3	0.21	0.16	0.13	0.09	0.07	0.13	0.16	0.21	0.22	0.33	0.38	0.25	
			200	0.18	0.29	0.35	0.34	0.34	0.24	0.19	0.17	0.13	0.12	0.08	0.09	0.14	0.19	0.23	0.22	0.32	0.41	0.25	
SYB-L02（低频型）(Low frequency)	400～600	基板喷砂，后贴 10mm 厚吸声棉 Spraying sand on the panel and 10mm wool behind it	50	0.32	0.35	0.41	0.52	0.55	0.52	0.58	0.49	0.43	0.41	0.43	0.39	0.37	0.20	0.32	0.33	0.35	0.37	0.40	
			100	0.42	0.40	0.46	0.59	0.60	0.58	0.51	0.55	0.48	0.42	0.40	0.37	0.34	0.23	0.33	0.30	0.32	0.38	0.45	
			200	0.45	0.54	0.59	0.65	0.69	0.64	0.60	0.57	0.54	0.47	0.45	0.43	0.42	0.36	0.43	0.41	0.43	0.35	0.50	

注：若有特殊吸声设计需求，可协商定制。
Note: Customized if there is any special acoustic design requirement.

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