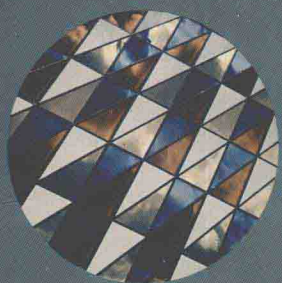


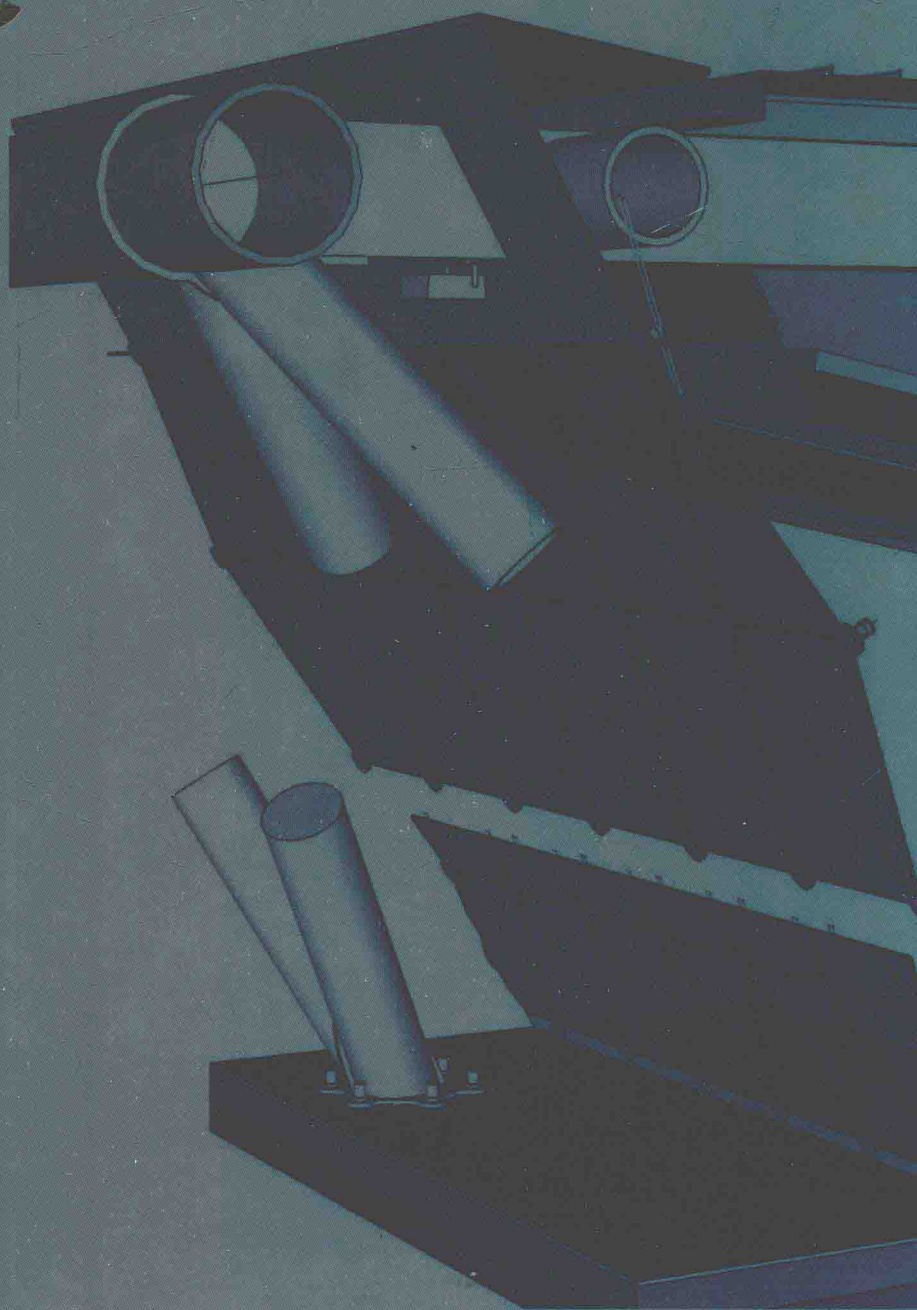
# Architectural Material & Detail Structure

## 建筑材料与细部结构

(英) 罗素·布朗 编 常文心 译



Glass 玻璃





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Glass 玻璃



# Preface 前言

## ARCHITECTURE IN GLASS Fear of Glass

### 玻璃建筑 对玻璃的恐惧

The buildings in this book are enclosed in glass, but perhaps they are "revealed" by glass. It could be argued that the choice of a glass skin is to avoid or negate the "façade" and simply modify the climate between outside and inside. If colour or pattern is added to the glass, does this mediate the flow of space from inside to outside, does it make a façade or just make this surface the viewer aware of the absence of a façade?

The treatment of a building's façades is still the most important part of any design to the architect. This is in contrast to the views of most users, who would argue that it is the interior design and the floor layouts where the most time and care should be spent! Clients often say to us "the outside of a building is just for the planners' and the architects' benefit. We are inside working or living, we only see the outside when we go in or out, and that's mostly in the dark".

Josef Quetgas in "Fear of Glass", a lecture about Mies van der Rohe's Pavilion in Barcelona, traces the meaning of glass back to the early modern architects. "Glass, the emblematic material of modern industrial production, being the result of pure spirit and not of the hesitancy and inertia of handiwork; glass made from a molten mass that comes to express a geometrical will". He describes the development of the use of glass from 1900 to the 1930s as a "glass chain" [1], of which the buildings in this book are a continuum.

Recent critical writing has concerned itself, again, with the issue of transparency and the fact that just because a glass building is transparent and does not make it democratic or the activities inside any more public or accountable, than something clad in solid stone. Hal Foster [2] has written, Consider Transparency. Again, like its modern predecessors, "Foster" suggests an analogy between architectural and political openness, not only at the Reichstag but also at City Hall. (Foster claims that "It expresses the transparency and accessibility of the democratic process," we are told; Londoners see the Assembly at work). [3] Yet the analogy is shaky from the start. How can architects continue to sell this line? Or, more saliently, why do we continue to buy it? Is it out of a sentimental attachment to the old virtues of

transparency, and the wistful hope that appearing so will make it so? In any case, such transparency is subject to different interpretations: open office spaces might appear non-hierarchical and democratic to the architect or even to the boss, but panoptical and oppressive to the employees. Then, too, as suggested, what once seemed transparent can now appear spectacular, whereby light and glass no longer signify civic accountability so much as mass attraction. Already, with its glass curtain wall for Willis Faber, "Foster" favoured dramatic effects, and this fascination continues through the Reichstag, whose cupola serves as an observation deck by day and a "beacon" by night. In this manner an exhibitionist streak runs through "Foster" and other prominent practices today as well (Herzog and de Meuron come to mind). A spectacle society invites it, of course, and these architects can hardly be blamed for the society – but must they comply so brilliantly with its problematic desires. [2]."

Interestingly, Hal Foster points out that the original enthusiasm of modern architects like Bruno Taut or Mies van der Rohe, for glass façades was for the possibilities of spatial complexity and the ideas of superposition and synchronicity that came more from art movements like Surrealism and Futurism. The architect/artists were seeking to express the passing of time and the multi-dimensions of space rather than a concern for openness or honesty in function. They saw the use of glass as representative of modernisation. Paul Scheerbar, a German architectural theorist, was a major influence on Walter Benjamin, Walter Gropius and Bruno Taut. From the late 1880s to his premature death in 1915, he wrote prolifically on science, urban planning and design, space travel, and gender politics, often in the course of a single text. His most celebrated treatise "Glass Architecture" (Glasarchitektur, 1914, [4] foretold of a sublime, technocratic civilisation whose peaceful world-order was borne from the proliferation of crystal cities and floating continents of chromatic glass. A vision summed up in his aphorism: "Coloured glass destroys all hatred at last". [4] At the turn of this century Venturi and Denise Scott Brown created a whole misplaced, misunderstood and now (hopefully) discredited approach to façades that gave primacy to their meaning over and above their usefulness or relevance to their context.



与其说本书中的建筑是被玻璃封闭起来,倒不如说它们是呈现在玻璃之中。玻璃幕墙的使用能替代传统的建筑立面并简单地调节室内外的气候环境。如果在玻璃上添加色彩或纹理,是否能调节室内外空间的动线,又是否能让观察者意识到“建筑立面”的存在呢?

建筑立面的处理一直是建筑师设计任务中最重要的部分。然而,大多数用户会认为室内设计和楼面布局是最重要的,因为他们的大多数时间都在那里度过。委托人总是对我们说:“建筑的外观都是为规划者和建筑师的利益设计的,我们在室内生活和工作,只能在进出时看到建筑外观,并且大多数时间是在早晚,天还是黑的。”

约瑟夫·奎特加斯 (Josef Quetgas) 在有关密斯·凡·德罗 (Mies van der Rohe) 的巴塞罗那馆的讲座《对玻璃的恐惧》中探讨了玻璃对于早期现代建筑师的意义。“玻璃,现代工业生产的象征材料,是纯粹精神的结晶,而不是落后的手工制品;由熔体制成的玻璃体现了一种几何感。”他将 20 世纪初至 20 世纪 30 年代的玻璃应用史形容为“玻璃链”<sup>[1]</sup>,而本书中所收录的建筑正是这条链条的延续。

近期的评论文章再次聚焦于玻璃建筑的通透问题,认为虽然玻璃建筑是透明的,但是它并没有比不透明建筑显得更加民主或大众化。例如,哈尔·福斯特 (Hal Foster) <sup>[2]</sup> 发表的《论透明性》。与前人一样,他们在建筑开放性和政治开放性之间做出了类比,不仅讨论了德国国会大厦,还讨论了市政厅。(福斯特认为“它表现了民主进程的透明性和可达性”。例如,伦敦人能看到议会的工作进程。)<sup>[3]</sup>但是这种类比的基础是薄弱的。建筑师如何一直以此为卖点?或者说,我们会一直买账吗?这是不是出于我们对透明性的一种眷恋和渴望?不同的人对透明性有着不同的解释:开放式办公空间可能会显得不分等级,让建筑师乃至老板认为是民主的。但是从员工的角度来说,这让他们完全暴露出来,有一种压迫感。此外,曾经透明的设计现在会显得更具肃穆感,因为光和玻璃不再能代表公民义务。在韦莱·费伯公司的玻璃幕墙设计中,建筑师青睐戏剧化的效果。德国国会大厦的设计延续了这种方式,建筑的圆顶白天是观景台,晚上则成为了“灯塔”。这种做法体现在许多力求表现自己的设计之中。当然,我们的社会追求奇观奇景,不能因为社会而批评建筑师,但是他们确实不应顺应这种有问题的趋势。<sup>[2]</sup>

有趣的是,哈尔·福斯特 (Hal Foster) 指出,布鲁诺·陶特 (Bruno Taut)、密斯·凡·德罗 (Mies van der Rohe) 等现代建筑师对玻璃立面最初的热情来自于空间复杂性以及来自于超现实主义、未来主义等艺术运动的叠加思想和同步思想。建筑师和艺术家试图表现时间的流逝和多重空间维度,而不是关注开放性或实用性。他们把对玻璃的应用看成是现代性的代表。德国建筑理论家保罗·谢巴特 (Paul Scheerbar) 对瓦尔特·本雅明 (Walter Benjamin)、沃尔特·格罗佩斯 (Walter





**Image1 Reichstag Dome**

**Source** Wikipedia

**Image2 Corby Cube**

**Source** Hawkins\Brown

**图1 德国国会大厦玻璃穹顶**

来源：维基百科

**图2 科比立方**

来源：霍金斯\布朗建筑事务所

The current exploration of façades by Herzog and de Meuron, Gigon Guyger or OMA and other "minimalists" is focused on intriguing games of decoration, scale or repetition. They use new materials, opportunities from new reproductive technology and reproduction in a visual language that creates intriguing perceptions or effects. They are not obsessed with a "thin" meaning over what effects can be achieved.

Herzog and de Meuron use serial units in such a way that material and image are all but conflated, sometimes with materials deployed as images and sometimes the reverse. For example, on the façade of the Ricola Production and Storage Building (1992-1993) in Mulhouse-Brunstatt, France, a photograph of a leaf by Karl Blossfeldt (from his 1928 *Urformen der Kunst*, which sought to disclose the "architecture" of nature) is silk-screened inside plastic panels; and on the exterior of the Technical School Library (1994-1997) in Eberswalde, Germany, various motifs based on press photos, selected by the artist Thomas Ruff are printed on concrete panels.

In conversations Hawkins\Brown have had with Aaron Betsky about Corby Cube or Royal Veterinary College, he recognises a similar strand of thinking running between seemingly very different projects. He identifies where a "thin" but not a transparent building skin (or façade) reveals or focuses attention on areas of a building that give a clue to its use, its values or priorities. This thin skin is clearly impacted by what is happening inside revealing elements of structure, showing floor levels or staircases in a way that allows the building to be understood by the onlooker, but not everything is revealed!

So it is with Hawkins\Brown [5], says Betsky. The result is evident first and foremost in what is absent from this work. Those architects who came to prominence around the turn of the millennium revolted against the empire of expressive structures decreed by the Lords of High-Tech who still dominate large construction projects in and around London. They are not interested in showing how buildings are made or in reasserting a sense of monumentality. Instead, they want to make buildings that are light, logical and open. They want what goes into them (function, context, people) rather

than what they are made of, to make sense. In London today, there are many children of Stirling and Archigram (and, behind them, the critic Reyner Banham), and Hawkins\Brown is among the best. Some of the practice's most remarkable buildings, such as the Cube in Corby, reflect the notion that an open, technology-informed framework can provide spaces where people can meet and form social bonds while engaged in work or research, or while obtaining social services. The practice concentrates to a large degree on injecting a sense of civiness that attempts to be open-ended, conducive to both social interaction and production, and disciplined in its appearance.

It is just as important how the outside skin is seen and perceived from the inside of the building. Is the internal façade understood as part of a whole, or does each room have its different form of enclosure? Is the outside wall different from a partition wall? A glass façade makes it difficult to create a sense of enclosure and control that can allow the designer to choreograph a series of almost stage like effects. But it is this sort of enclosed building an architecture of a different time and place. Or is the use of glass still a stylistic necessity for the modern architect?

#### References

##### 注释

- [1] Josef Quetgas in *Fear of Glass* (Birkhauser, 2001)
- [2] Hal Foster in the *Art-Architecture Complex* (verso: London, 2011)
- [3] Norman Foster in 'Catalogue: Foster and Partners' (Munich: Prestel Verlag, 2005)
- [4] Paul Scheerbart in *Glasarchitektur* (1914)
- [5] Aaron Betsky in *Architectural Review*, London, 2013

Gropius) 和布鲁诺·陶特 (Bruno Taut) 的影响很大。从 19 世纪 80 年代末至 1915 年早逝之前, 他撰写了大量有关科学、城市规划与设计、空间旅行、性别政治的文章。他最著名的论述《玻璃建筑》(*Glasarchitektur*, 1914) [4] 预言了一种崇高的文明。在那里, 水晶城和漂浮的彩色玻璃大陆衍生了和平的社会秩序。他总结道: "最终, 彩色玻璃打破了一切仇恨。" [4] 在 20 世纪与 21 世纪的交界点, 文图里 (Venturi) 和丹尼斯·斯科特·布朗 (Denise Scott Brown) 打造了一种错位、错乱的立面处理方式, 让立面的象征意义凌驾于功能性或环境关联之上。

当前, Herzog and de Meuron 建筑事务所、吉贡·盖格尔 (Gigon Guyger)、大都会建筑事务所 (OMA) 等"极简主义者"所探索的立面设计聚焦于装饰、比例和重复的组合。他们运用新材料、生产技术带来的新机遇以及视觉语言的重复来打造吸引人的感官和效果。他们不再沉迷于"薄"的效果意义。

Herzog and de Meuron 建筑事务所采用连续的组合, 使材料与图像相互转化和结合。例如, 在利口乐生产与仓储楼 (法国, 米卢斯, 1992-1993) 的立面设计中, 由卡尔·布罗斯菲尔特 (Karl Blossfeldt) 所拍摄的叶子照片以丝印的方式呈现在塑料板上; 在技术学校图书馆 (德国, 埃贝尔斯瓦尔德, 1994-1997), 由艺术家托马斯·拉夫 (Thomas Ruff) 所挑选的基于新闻照片的各种图案被印在了混凝土板上。

在霍金斯·布朗事务所 (Hawkins\Brown) 与亚伦·贝斯基 (Aaron Betsky) 讨论科比立方或皇家兽医学院的设计时, 他承认了这两座看似截然不同的建筑拥有相似的设计思想。他指出, "薄"而不透的建筑表皮 (或立面) 能让人把注意力放在建筑的功能、价值或优先点上。这层薄薄的表皮受到内部活动的明显影响, 能呈现结构元素、楼层或楼梯, 既让路人理解建筑, 又能隐藏必要的空间。

贝斯基认为这就是霍金斯·布朗事务所 (Hawkins\Brown) 成功的原因之一 [5]。在 20 世纪末、21 世纪初成名的建筑师们开始反对表现式结构设计 (在伦敦及其周边地区, 这种设计仍然是主要趋势)。他们无意于展示建筑的建造结构或表现宏大感。相反, 他们希望让建筑轻盈、清晰、开放。他们希望建筑内部的东西 (功能、环境、人) 而不是建筑的构成成为主角。在当今的伦敦, 斯图灵学派和建筑电讯派有许多追随者, 霍金斯·布朗事务所 (Hawkins\Brown) 是其中的翘楚。科比立方等代表性作品反映了开放的技术框架既能为人们提供交流会面的空间, 又能打造工作、科研或获得社会服务的空间。霍金斯·布朗事务所 (Hawkins\Brown) 十分注重公民感的注入, 力求实现一种有助于社会交流和生产的开放感, 同时又倾向于严谨的建筑外观。

建筑内部对建筑外表皮的感官同样重要。内层立面是一个整体, 还是每个房间都有自己独立的封闭方式? 外墙与隔断墙是否一样? 玻璃立面很难营造出封闭感, 也无法让设计师编排出各种奇妙的舞台效果。但是这种封闭式建筑能穿越时空, 形成经典。莫非玻璃的应用仍然是现代建筑师必备的风格元素?

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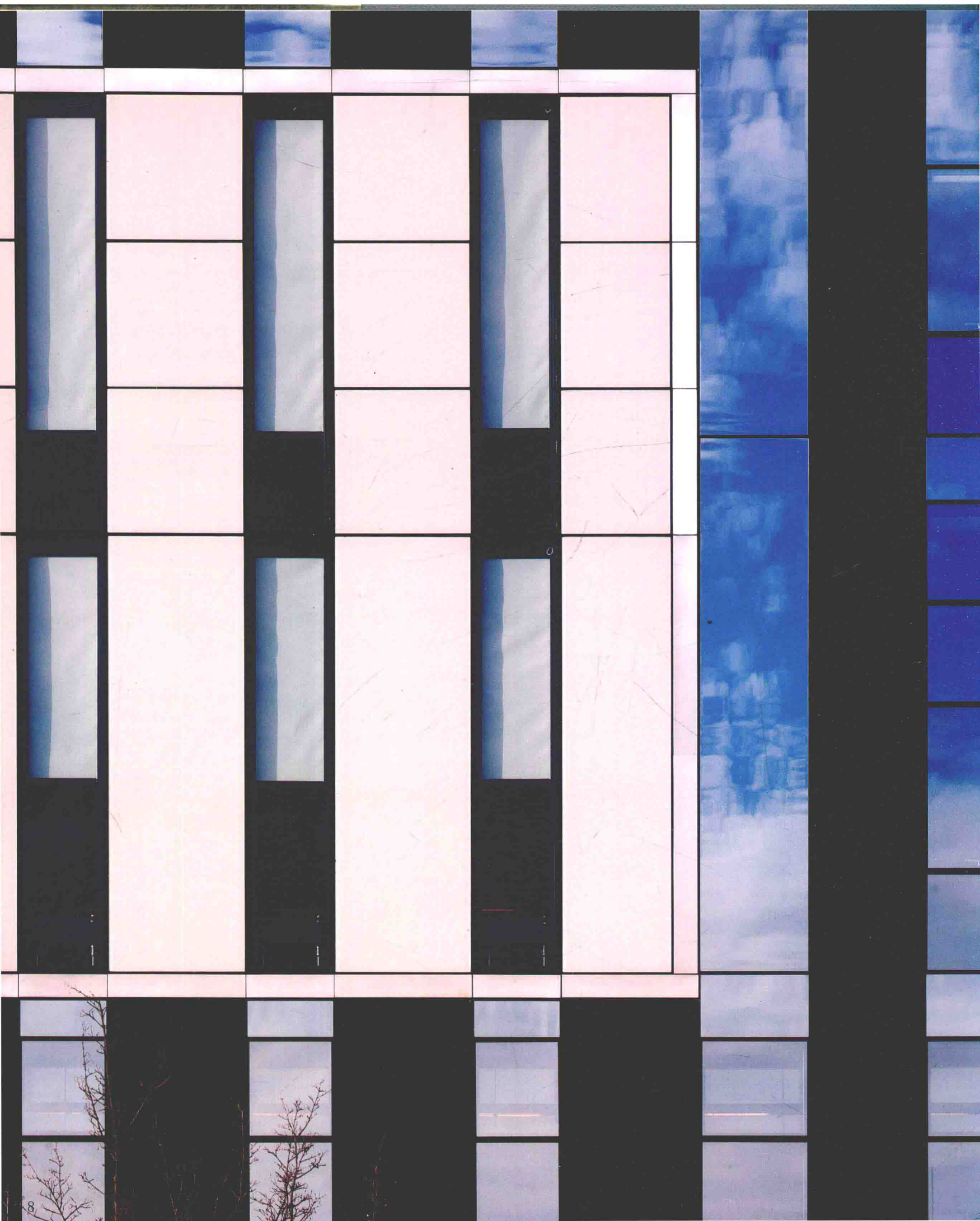
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# Overview General Information of Glass

## 概述

## 玻璃知识简介

### 1. Definition and Properties

Glass is an amorphous solid (non-crystalline) material that exhibits a glass transition, which is the reversible transition in amorphous materials (or in amorphous regions within semi-crystalline materials) from a hard and relatively brittle state into a molten or rubber-like state. The most familiar type of glass is composed silicon dioxide ( $\text{SiO}_2$ ), sodium oxide ( $\text{Na}_2\text{O}$ ), lime ( $\text{CaO}$ ), and several minor additives, with  $\text{SiO}_2$  as its main ingredient.

Glass is extensively used in architecture to insulate wind and transmit light. The followings are some of its properties:

\*Glass has a good light transmittance performance, e.g., the visible light transmittance of optic glass with 3mm thickness is 87%, while that of optic glass with 5mm thickness is 84%. Glass has a high transmittance of near-infrared rays and can block far-infrared rays refracted to interior walls, floor, furniture and fabrics, producing a obvious “greenhouse effect”. Besides, optic glass has a low transmittance to ultraviolet ray.

### 1. 定义及特性

玻璃是一种透明的半固体、半液体物质，在熔融时形成连续网络结构，冷却过程中黏度逐渐增大并硬化而不结晶的硅酸盐类非金属材料。普通玻璃化学氧化物的组成( $\text{Na}_2\text{O} \cdot \text{CaO} \cdot 6\text{SiO}_2$ ),主要成分是二氧化硅。

玻璃广泛应用于建筑，用来隔风透光，属于混合物。具有一系列的特性：

\*良好的透视、透光性能（3mm、5mm厚的镜片玻璃的可见光透射比分别为87%和84%）。对阳光中近红外热射线的透过率较高，但对可见光折射至室内墙顶地面和家具、织物而反射产生的远红外长波热射线却有效阻挡，故可产生明显的“暖房效应”。镜片玻璃对



\*Glass has some sound insulation and thermal insulation properties.

\*With tensile strength far lower than compressive strength, glass is a typical brittle material.

\*Glass is chemically stable. Under normal conditions, it is resistant to acid, alkali, salt, chemical reagent and gas; yet long-term contact with corrosive media also lead glass to corrode and damaged. Weathering and moldiness both result in damages in glass' s appearance and transmittance.

\*Glass is unstable to heat and easy to crack in extreme cold or hot conditions.

\*Coloured sheet glass can be jointed and is corrosion resistant, anti-scouring and easy to clean.

\*Enameled glass is chemically stable and suitable for decoration.

\*With different patterns and crafts, patterned glass, sprayed glass, etched glass and ice glass vary in their colours, looks, and gloss effects, decorative and attractive.

\*Tempered glass is mechanically strong, resilient, and thermally stable. It is less likely to cause injury once broken. The shortcoming is that it may self-explode.

\*Wire glass won' t fly off when it is stroke or broken due to temperature shock. It can prevent fire spread for a while and plays a role in burglary and robbery prevention.

\*Laminated glass is highly transparent and shock resistant. Laminated PVB film protects the fragments from injury. It is also durable, moisture-proof and low temperature resistant.

\*Stained glass can absorb solar radiant heat effectively to achieve thermal insulation and energy efficiency. It absorb large amount of visible light and soften transmitted light. It prevents ultraviolet rays through absorbing them. The colour of stained glass is durable and bright, apt for architectural appearance.

\*Reflective glass has a good thermal insulation performance but may cause light pollution to outside environment.

\*Insulated glass has good optic performance and thermal insulation performance. It is also sound-proofing.

## 2. Development and Application in Architectural Industry

It is difficult to verify where and when glass is first founded or created. It is generally believed that the longest history can be dated back to 5BC. Glass was first used in architectural industry in Pompeii during Rome Period. In earlier classic architecture, glass was only used in special buildings such as churches and monasteries. In 18th century, with great development in glass production technology, glass was extensively introduced to architectural industry. In 19th century, architects started to use glass to overthrow the traditional architectural image of solid brick and stone. In late 20th century, architectural works by masters such as Glass Pyramid in the Mussee de Louvre by I. M. Pei, Crystal Cathedral by Philip Johnson had made a stir and were rather representative.

Today, with the development of production and processing technology, glass is used in various functions, from traditional window, curtain wall to interior and exterior wall decoration and floor. (See Figure 1 to Figure 4)

## 3. Glass Products Used in Architecture

### Float Glass

Float glass is a sheet of glass made by floating molten glass on a bed of molten metal, typically tin. This method gives the sheet uniform thickness and very flat surfaces. Made of silica sand, float glass is transparent, bright and colourless. Without any glass boil or bubble inside, float glass feels smooth and heavy. Compared to plate glass with same thickness, float glass is much higher. It is also easy to cut and difficult to break.

Float glass is an ideal material for civil buildings. Compared to plate glass with same thickness, its price is only 4 RMB higher per square metre. The dimension of single piece of float glass is becoming increasingly larger. For example, Luoyang Float Glass Group in China has created a piece of 25mm float glass with dimension of 4.2mx25m.

太阳光中紫外线的透过率较低;

\*隔声、有一定的保温性能;

\*抗拉强度远小于抗压强度, 是典型的脆性材料;

\*有较高的化学稳定性, 通常情况下, 对酸碱盐及化学试剂和气体都有较强的抵抗能力, 但长期遭受侵蚀性介质的作用也能导致变质和破坏, 如玻璃的风化和发霉都会导致外观破坏和透光性能降低;

\*热稳定性较差, 极冷极热易发生炸裂;

\*彩色平板玻璃可以拼接, 并有耐腐蚀、抗冲刷、易清洗等特点;

\*釉面玻璃具有良好的化学稳定性和装饰性;

\*压花玻璃、喷花玻璃、乳花玻璃、刻花玻璃、冰花玻璃根据各自制作花纹的工艺不同, 有各种色彩、观感、光泽效果, 富有装饰性;

\*钢化玻璃机械强度高、弹性好、热稳定性好、碎后不易伤人、可发生自爆;

\*夹丝玻璃受冲击或温度骤变后碎片不会飞散; 可短时防止火焰蔓延; 有一定的防盗、防抢作用;

\*夹层玻璃透明度高、抗冲击性能高、夹层PVB胶片黏合作用保护碎片不散落伤人, 耐久、耐热、耐湿、耐寒性高;

\*着色玻璃有效吸收太阳辐射热, 达到蔽热节能效果; 吸收较多可见光, 使透过的光线柔和; 较强吸收紫外线, 防止紫外线对室内影响; 色泽艳丽耐久, 增加建筑物外形美观;

\*镀膜玻璃保温隔热效果较好, 易对外面环境产生光污染;

\*中空玻璃光学性能良好、保温隔热性能好、具有良好的隔音性能。

## 2. 发展及在建筑中的应用

玻璃的发源地以及其产生时间如今已很难考证, 一般认为可追溯到公元前5世纪。玻璃最早被应用在建筑领域即为罗马时期的庞贝古城。在西方早期古典建筑中, 玻璃仅用于教堂、修道院等特殊类型的建筑。19世纪玻璃生产技术取得了重大进步, 至此玻璃开始大规模进入建筑行业。20世纪, 玻璃制造业的发展为其大面积运用创造了必要条件, 使建筑师能够打破传统封闭的砖石形象, 并因此受到偏爱。20世纪后期, 玻璃幕墙随着摩天大楼的诞生而出现。不可否认, 玻璃在建筑中的应用已经进入了一个新的时期。很多大师的作品, 如贝聿铭设计的巴黎罗浮宫玻璃金字塔、菲利普·约翰逊设计的水晶教堂等, 都曾引起轰动, 并具有很强的代表性。