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Clay Bricks

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Clay bricks are a traditional building material that has been used since ancient times and continues to be utilized today. They are the primary material in several countries, including Iraq. This research explores the evolution of clay bricks from traditional materials into smart materials with advanced technical properties. The development process involves adding smart elements and technologies aimed at enhancing the strength and durability of the bricks, making them responsive smart materials that can adapt to various conditions and provide optimal comfort within the space. These materials include nanomaterials, carbon fibers, and other substances, each serving different functions depending on their location within the building, The aim of the research is to achieve well-insulated buildings that provide comfortable internal functions and ensure an ideal human environment.

1 Introduction

Bricks are considered essential materials in the construction of structures and buildings, especially it used historically dating back to thousands of years. The use of traditional brick began in ancient times; notably, it was made from clay and left to dry under the sun's ray. Traditional brick primarily relies on natural materials such as clay, sand, and gravel, taking into account the drying process that requires a long time before being used in construction operations. Traditional brick had witnessed many developments in terms of manufacturing methods, construction techniques, and other methods. The emergence of fired clay brick, which is characterized by its strength and durability, surpassed the old traditional brick that engineers relied on for many years. After the digital revolution, architecture has developed gradually across the whole world in construction methods, finishes, and materials, as much as modern technologies have progressed. Architectural creativity is no longer limited to aesthetic and functional proportions; architects are now required to be well-versed in all the technological advancements that have changed the design and operation of buildings, as well as their users. As a result of ongoing powerful development, the concept of 'smart brick' has emerged, representing one of the positive aspects of the millennium that continues to be developed nowadays [1]. This marks a significant leap in the construction field, combining

traditional brick properties with modern technology. Advanced and intelligent materials are used in the manufacturing of these bricks, making them more efficient in thermal and sound insulation, thus providing a comfortable indoor environment for the building occupants."

Consequently, the use of bricks as building material dates back more than 5000 years, taking into account some the communities that lived earlier in the Middle East used bricks in buildings, particularly the inhabitants who lived in Mesopotamia, who utilized sun-dried bricks. Subsequently, Babylonians started to manufacture and shape brick, employing it in construction to build their civilization and towers [2] . Brick manufacturing in Iraq was concentrated in the central and southern regions due to the abundance of clay, while in the northern region, stones were used due to their availability [3].

2. Bricks

The term " 'brick[1]' refers to regularly shaped building units used in with dimensions that do not exceed a certain limit. Bricks can be manufactured from clay, concrete, stone, and the substance called Nora, or a mixture of various materials. As a result, bricks are considered important manufactured materials, and their manufacturing methods have gradually, with various shapes, colors, and durability to achieve architectural goals [4]. Bricks are typically made from firing clay, bonded together with mortar usually consisting of cement, sand, and water [5]. The brick-making industry is often located outside urban areas due to the environmental pollution caused by the smoke emitted from the kilns, which pollutes the surrounding areas. Clay is usually cut into known brick dimensions and then fired in specialized kilns at temperatures ranging from 750 to 1000 degrees Celsius. Different types of bricks are produced depending on the varying temperatures." [6]

Relatedly, from a terminological perspective Bricks , as a term, refers to a building unit made of sturdy and strong inorganic metallic compounds with regular geometric shapes. Bricks are known by various names, depending on the type of raw material they are composed of, their source, and the method of their preparation in their various forms, as well as their resistance to harsh conditions [4]. Or it can be considered a solid piece made of clay, sand, or any other material manufactured in regularly shaped dimensions that can be easily made, transported, and used in construction. It has the ability to bear loads and resist impacts and weather changes." [6].

2.1 Kinds of traditional bricks

[1] In the past, the size of bricks have amount of space used to reach30*30*7 cm or more taking into account when the brick is larger in its space causes an additional progressive leads to be more binding in the process of construction, fewer joints and the load bearing capacity of wall will be stronger, but such a process will be accompanied with some difficulties in carrying, using, and transporting the brick further, the ease of breakage during transportation[4] .After a period of time, they reduced the size of the bricks because it was more practical than the previous size, with dimensions reached to 25*12*7

We can observe many differences during the stages of developing bricks , from their first appearance as a material of building to the present time, and the changes they have undergone in terms of shape, weight, size, and performance. The classification of bricks depends on several factors, including their chemical and physical composition, manufacturing method, and their use as well as the raw materials contained within.

Kinds of bricks according to their Constituent materials [7] [4]

1. Clay Bricks
2. Glass Bricks
3. Sandbar (Al-Jairy)
4. Concrete Bricks

2.1.1 Clay Bricks

Clay Bricks are made of clay materials containing primary elements of metallic compounds in which there are varieties in their proportions , whose presence depends on the choice of quarries due to each kind of quarry has its own geological formation, resulting in various types of manufactured bricks. . This may require mixing two types of soil to obtain a specific type of brick. [8]. Clay is the primary raw material in brick manufacturing, possessing certain properties such as plasticity that allow it to be molded and shaped when mixed with water. Therefore, the process of manufacturing clay bricks relies on many stages, including raw material preparation, molding, drying, firing, and cooling. [2]

Accordingly, clay bricks have many features that make them an effective and durable building material. Thus, their quality and characteristics depend on the raw materials used in their manufacturing.

Raw materials are as follows: [4]

1- **Ordinary clay:** This kind of clay is formed as a result of many mechanical breakdowns of sedimentary rocks, which have not been transformed into a solid substance, retaining their powdery, compacted form while retaining their softness properties.[8, P:6].
2- **Pottery clay:** This kind of clay is similar to clay in its formation and basic elements, except it retains smoothness and a certain hardness. [9].
3- **Soft clay rocks:** This material is formed as a result of many formations composed of sedimentary clay materials with small particles similar to ordinary clay[9].
4- **Fractured clay rocks:** This material is considered sedimentary rocks was formed due to they that have being subjected to intense earth pressure, affecting their hardness and weakening their strength[9].

2.1.1.1. Kinds of clay bricks [4]:

1 Surface bricks: These bricks have dimensions of (25*25*50) cm and were used in surface applications.(fig.1)

2- Brush bricks: These bricks have dimensions ranging from (28*28*60) cm to (30*30*70) cm and were used in certain floor applications, especially damp areas. Later, this type was used in wall cladding, as it is manufactured from materials containing sulfur that give the brick a golden yellow color.(fig. 2)

3- Fire bricks: This type of brick is used for lining furnaces, ovens, chimneys, and fireplaces because it can withstand high temperatures. It is manufactured from special clay types, such as kaolinite or silicon. It contains at least 92% silica [4], enabling it to withstand much higher temperatures than ordinary clay bricks [10].(fig.3)

4-Glazed bricks: These are clay bricks with a ceramic coating in which one or more faces are coated with a material that has been vitrified by heat, giving them a glossy and colorful appearance[4] .(fig.4)

Fig 1: surface bricks , fig 2: brush bricks fig3: fire bricks fig 4: glazed bricks

Clay bricks have a specific set of properties, including:

1. Porosity, durability, and water absorption
2. Presence of soluble salts
3. Thermal insulation and fire resistance

2.1.1.2 Clay Brick Shapes [8]

1- Solid bricks: This type of brick contains no more than 25% of its volume in both permeable and impermeable pores. It has a higher load-bearing capacity compared to other types, and it is used in foundations and construction.

2- Perforated bricks: This type of brick contains more than 25% of its volume in holes. It has less load-bearing capacity than the first type, which is solid brick, and it is used in buildings and structures that are relatively loaded, as well as in partitions and barriers.

3- Hollow bricks: This type of brick contains voids that increase its volume by 25%. The void is undefined, and this type is used in partitions and non-load-bearing walls.

4- Cellular bricks: This type of brick has voids that make up more than 25% of the brick's volume and it has the same uses as hollow bricks.

2.1.2 Glass Bricks

Glass Bricks are made of pieces of construction glass with one or two glass faces and they're hollow from the inside. It comes in various shapes, including many shapes such as circular, and, rectangular, with different and variable dimensions, usually between 8 to 20 centimeters, and a thickness of about 12 centimeters (fig. 5). Common dimensions include (14, 6 *14*6)

and (19.7 * 19.7) centimeters for squares, (19.7 * 9.5) centimeters for rectangles, with a thickness of 8 to 12 centimeters [3]. The adjacent sides of the faces are rough-textured and have one or more longitudinal protrusions to ensure bonding with the binding material.[9].

Fig.5 glazed bricks

2.1.2.1 Uses of glass bricks [4]

- First use: this is used for architectural purposes, which use decoration and natural lighting in specific locations as needed without compromising privacy inside and outside the place.
- Second use: this is used in specific work places instead of windows to prevent dust from entering, as in some precision industries such as pharmaceuticals, electronics, and others.
- Third use : this is used in walls and ceilings where windows cannot be used due to the risk of ordinary glass breaking easily, in addition to obstructing the view, such as in the walls and ceilings of basements .

2.1.3 Sand Bricks (Limestone)

This type of brick is made from a homogeneous mixture of pure sand, not exceeding 90%, and lime (calcium oxide) in a proportion not exceeding 10%, ensuring that the magnesium oxide content in the mentioned materials does not exceed 3%. water is added to the mixture to transform it into a paste, which is later cut and compressed using devices capable of applying pressure equivalent to 16 atmospheric pressure. It is then exposed to temperatures of up to 200 degrees Celsius, causing suitable bricks to use. [8]

2.1.3.1 Features of Sand Bricks [9].

1- They tend to be more regular than clay bricks due to their nature in comparison with clay bricks, as well as sand bricks are compressive as they avoid of entering heat furnaces
2- They are free from soluble salts and therefore free from efflorescence
3- They do not require saturation with water during construction
4- They are characterized by straight and sharp edges, free from cracks, and their surface does not corrode over time. Moreover, they are bricks that can be painted with different colors, making them suitable for use in building facades.

2.1.4 Concrete bricks

This kind of brick is made of a mixture, consisting of cement, sand, and gravel in proportions ranging from 1:2:4 to 1:8:16), [9]. This means Portland cement, fine and coarse aggregates,

as well as a specific quantity of water, and some additives may be used for coloring and modifying the properties in which they interfere with the resulting bricks. The cement that is used in producing the aforementioned bricks can be either ordinary or salt-resistant, depending on the nature and color of the required. Add to this its dimensions , which are similar to clay bricks [8], taking this into consideration, this kind of bricks are often hollow to reduce the amount of used concrete and to increase insulation. notably the voids in this brick are typically of different shapes, such as square, circular, or rectangular shapes [9].

Concrete bricks are used in constructing load-bearing internal and external walls, as well as partitions and bases. They are also utilized for wall cladding, where either their natural color or another type of colored brick is used. (8)

Many buildings are constructed by using traditional bricks as a material with construction techniques that provide a comfortable indoor environment for their occupants

Bait Al-Raouf Mosque 2012

Location	It is located in Bangladesh/ Dhaka	**Build completion**	*2012*
Function	Religious building, recreational field and gathering area	**Executing engineer**	Marina Tabassum
The used material	Traditional brick		

The traditional brick was used based on traditional methods, in addition to being an attempt to create a unique architectural language rooted in the illustrious heritage of mosque architecture, taking into account preserving engineering contemporary expressions[11] . Thus, this mosque makes a difference regarding the concept of traditional mosque construction; it does not rely on size and ornamentation, indicating that the mosque's construction is non-traditional. This is embodied through the reduction of the dome and minaret, emphasizing the unsuitability of using a dome in rainy weather prone to flooding in Indonesia.

Fig.6 mosque architectural elements

The mosque contains several exquisite architectural elements, including:

- shows spiritual feeling through the use of sunlight fig.6(a)
- shows the use of local materials and making an opening in the structure of wall 's building indicating the direction of the prayer qibla fig.6(b)
- shows the ablution places and the use of concrete bricks in all parts of the mosque fig.6(c)
- shows the openings in the structure of wall 's ceilings that symbolize the stars, meteors showers, and spirituality fig.6(d) [11]

Thus, the creativity of the architectural design Bait Al-Raouf Mosque in Bangladesh embodies the interconnectedness between architecture and humanity, as well as the adaptation of nature, especially sunlight. The architectural design concept of the mosque harmonizes with nature through by using variety methods. Furthermore, the appearance of exposed clay, which adds a character reminiscent of neighboring buildings' engineering, as well as religious architecture, and the use of porous bricks, which provide the hall a high standard of Identification and a cold environment [12].

2.2 The impact of technological development on brick manufacturing methods:

As it is known, modern constructions have become the fundamental factor in the development and creativity of the architectural world, which encompasses not only proportions, aesthetics, and functionality, but also that should be better than these dimensions of thinking which means that high-minded architecture should have enough knowledge about the latest technological advancements that influence the shape, design, operation of buildings, and effect their users [1].

The modern methods of manufacturing and using bricks in their various types and shapes coincide with the digital revolution and the significant changes it has brought to all fields, especially architecture, have made digital technology a force of innovation across various fields and specialties. Its impact has extended to updating traditional systems related to building culture and materials. Despite the strong flexibility offered by traditional brick construction due to the small size of bricks, it requires more time. This has led to seek for solutions by using digital technology to deal with this aspect of building as a whole. [13].

Smart technologies, refer to the chance of integrating other technologies because they are modern and involve using computer and communication technologies whereas previous techniques did not have such capabilities. This allows for material or technology to interact with other parts of the system, making the systems more efficient in the use of energy or more suitable for the functions they perform. [14]. Accordingly, scientists have developed methods for manufacturing and constructing bricks to enhance their features.

In order to achieve sustainable design, a scientist called Jong-Jin Kim proposed a framework for design consisting of three basic principles [15] which are as follows:

- Resources economy: This principle includes reducing the natural resources used in construction, reusing, and recycling them.
- Life cycle design: This principle includes providing a methodology for analyzing the construction process and its environmental impact.
- Human design: This principle includes focusing on interactions between the environment of building and the natural world, helping to provide a harmonious relationship.

Bricks can also be used for the rehabilitation of existing buildings, which involves four main aspects which are restoration, renovation, maintenance, and modern modification [16]. Thus, smart brick is considered a material within part of a comprehensive system network called smart city technologies, which are among the most important technologies that can be used in city management. accordingly this induce to achieve an environment without diseases for any city using such kind of technologies as well as increasing energy efficiency, and many other things [17].

2.2.1 Stages of smart bricks development

The evolution witnessed in the construction industry in the field of technology has led to the development of numerous methods and innovations, including the emergence of smart bricks as an advanced building material that offers many advantages and smart features. Smart bricks are characterized by their ability to provide integrated smart functions in the external structure of the brick, enhancing building efficiency. Various technologies have been applied to bricks, resulting in different types, including:

1- **Breathable bricks:** This is a stone system that filters polluted outside air to improve indoor air quality. This system does not use any filtration technology to separate suspended particles; instead, air creates a cyclonic effect by adopting the cyclone separator, which is considered one of the cheapest and most efficient types of separators as it is the main component of the breathing brick (fig. 10). Its efficiency depends on the size and speed of the particles, showing an efficiency of 70-80% in separating solid materials [18](fig. 12)

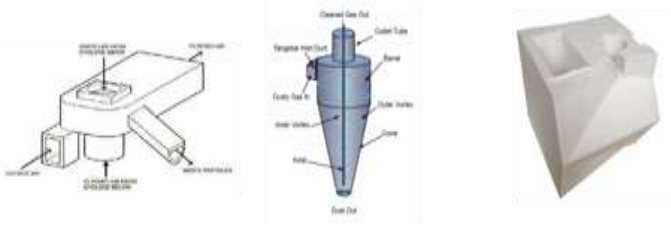

Fig. 11: Components of breathable bricks. Source: (18)

- **Concrete Brick**: The cyclonic separator is integrated within the construction component.
- **Cyclonic Separator**: It is the simplest and cheapest separator without moving parts, and it demonstrates efficiency in particle removal.
- **Recycled Plastic**: It helps align the blocks and creates a pathway for contaminated air to enter the block.
Fig.11 . source [18].

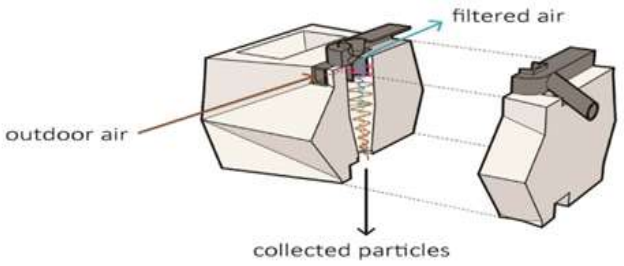

Fig. 12: The process of transferring polluted outside air

2- Lego Bricks: These are block models used in construction by systematically and orderly interlocking with each other. Lego bricks also reduce the use of binding material (mortar) or adhesive, thus providing convenience in terms of precision and use. This is due to their interlocking feature, which increases adhesion strength. [4]

The advantages of this brick [20]:

1. It resembles ordinary cement bricks in specifications and dimensions.
2. It does not require cement when being used in construction due to its interlocking nature, which requires the use of an adhesive material instead.
3. It significantly reduces construction costs.
4. It is characterized by its thermal insulation properties, thus saving energy consumed for cooling and heating.
5. It reduces the need for labor in construction.
6. It is fast and easy to install.
7. It is cheaper and more precise than traditional construction methods.

Lego bricks are manufactured from parts resulting from the crushing of limestone rocks, volcanic dust, or sand, and sometimes from plastic residue. The smaller the raw materials, the higher the quality of the brick. This brick comes in two types fig.13 [21] :

- Normal Lego shape: used in construction.
- U-shape Lego bricks: used in horizontal installations inside walls during construction (water or electrical pipes), as well as for creating supportive links.

Fig. 13: construction methods using LEGO bricks

fig .14 :types of lego [13]

Lego bricks were employed by an individual, James May, who used approximately 3 million bricks to build this house. He used a wooden frame for support reasons, as the 2x4 bricks are not qualified to bear heavy weights [12].

Fig. 15

James May's house built from Lego bricks. Source: [12]

fig. 16

Wooden frame for reinforcing the safety of the bricks to bear heavy weights. Source: [12]

3- Foam bricks: thanks to their innovative composition that includes traditional building materials and foam materials, offer exceptional advantages, making them the most suitable and best choice in the field of advanced and sustainable construction. Foam bricks combine lightness, thermal insulation, and flexibility, serving as a perfect alternative to traditional bricks [2].

Foam bricks come in several types, including insulated bricks, which are characterized by their high sound insulation capabilities and are used in constructing exterior and interior walls. Another type is lightweight foam bricks, which are known for being lightweight,

making them easy to install and transport. They are used on non-load-bearing walls. The last type is heat-resistant foam bricks, making them ideal for constructing fire-resistant walls in residential or commercial buildings. They are manufactured by mixing cement, sand, and water with a foam material such as polystyrene or cork [10].

4- Cigarette Blocks: Innovation in building materials has resulted in lighter, more efficient bricks. These bricks are manufactured from cigarette butts, which contain 2.5%, 5%, 7.5%, or 10% cigarette butt (CB) content by weight. They are tested and compared with clay bricks, which contain 0% CB. (18)

Fig. 17: Cigarette Butt Brick Source: [18]

5-Bio bricks: The idea is to use urea found in human waste to manufacture bricks. The production process takes between 4-5 days, and to obtain more durable molds, they must be left for a longer period. It has been found that the production process of bio bricks is more cost-effective when integrated with a comprehensive urea treatment system. [18]

Fig. 18: Bio Brick Source: [18]

6- Double smart bricks: refer to the standard double brick with eight holes. The structure of these bricks needs to be modified to include a power source and facilitate communication through transportation. One of the latest modifications is the removal of the three lower cylinders to provide space for the general circular panel and sensor devices. The power source is arranged in the upper part of the brick, and the connections are distributed over the recesses in the brick, as shown in the figure. [23]

Fig19

Fig20

Distribution of communication connections in the upper part of the brick. Source: [23]	: The double brick and how to install the power sources inside it. Source: [23]

7- Solar Bricks: Homes can be built using smart bricks that convert solar energy (sunlight) into usable electrical energy, referred to as solar squares. Designers have attempted to make these bricks suitable for any type of building or they may be part of the renovation process for old buildings. Each brick, or block contains smart optics that concentrate the sunlight inside, converting it into energy that can then be used to power the building. [5]

8- Using smart bricks as a new system in construction:
The company Kite Bricks has announced its intention to provide the world with smart bricks that can be used primarily in multi-story buildings and even skyscrapers. They are also suitable for small buildings, as they are manufactured to be high-strength concrete molds or light squares tailored to the need. Additionally, the installation of smart bricks includes cavities inside that make them lightweight and also provide high air and thermal insulation. [6, P: 3, 5]

9 - Smart Sensor Bricks:
These bricks can be used in several places and for several functions:

A - Smart Sensor Bricks for Structural Damage Detection:

These are electrically conductive and pressure-resistant clay bricks that produce a measurable change in their electrical resistance under an external load. Specific properties of the typical clay structure can be enhanced by adding a suitable conductive filler to the brick during the manufacturing process. Titanium dioxide (TiO_2) is used as a filler inside the brick due to its high resistance, ranging from 0.1 to 10, compared to the clay brick resistance of 1000. This type of brick can be used in critical locations of the structure. The manufacturing process involves preparing the nano-clay brick by adding 5% titanium dioxide particles, taking into account the weight of the wet clay[24]. This brick can self-sense in the structure, detecting changes in the structural behavior of the building it is part of, allowing early detection of cracks or any damage occurring in the building. [25].

B - Smart Sensor Bricks for heat, humidity and sound

This type of brick includes a sensor package for the wireless sensor node, consisting of a pair of ADXL 202 AE analog accelerometers for detecting temperature. This system is flexible and can include other sensors, such as humidity and sound detection. The sensor chip is embedded in the brick and can be used in fire curtain walls in staircases, sending information related to the safety of building exits during a fire. [26].

Fig. 21 Thermal sensor brick Source: [26].

2.3 Projects in which smart bricks were used

2.3.1 MIT Research Center Building E14:

location	**United States / Cambridge Massachusetts in**	**Build completion**	**2009**
Function	Multi-purpose building of laboratories, Offices and research center	architect	Japanese :- Fumihiko Maki
Material used	Smart bricks with electric carbon filaments		

The smart bricks have been employed in certain parts of the building rather than the entire structure. These bricks are distinguished by their electric carbon threads, which function to transmit information regarding energy usage and the conditioning of the internal environment.

Figure 22: Brick Utilization for Comfortable Interior Spaces

The research center was established in 1985 by Nicholas Negroponte and the former president of MIT, Jerome Wiesner. In March 2009, the Wiesner Building, located within the MIT Research Center complex, was expanded and developed [27]. This building is characterized by its glass walls and long lines of sight throughout. The building consists of six floors covering an area of 163,000 square meters, comprising laboratories, offices, and meeting spaces. It serves as an exhibition for new design concepts, with the primary goal of igniting new energy[28].

Figure 23: Low-Emission Glass and Aluminum Tube Shading Systems

2.3.2 Martinet Elementary School:

location	**Espain**	**Delivery**	**2010**
function	Educational Building	Architect	Mestura Co. By the work team Humbert Costas, Manuel Gomaz, Jaime Blanco
Material used	Smart bricks made of reinforced concrete		

Regarding the general layout of the building, it is surrounded by residential streets, a sports field, and a park. The project is distinguished by its U-shaped form, where each classroom is exposed to the open air and surrounded by a series of playgrounds for young people. The smaller, lower building houses shared functions such as the dining hall, gymnasium, and support facilities. It is connected to the main learning center through a third building where visitors and students are welcomed [29].

The building's facade consists of a network of ceramic stones designed to provide protection from the sun. The tiles are (300 x 200 mm) or (300 x 100 mm) in size with a thickness not exceeding 22 mm, arranged at right angles to each other in a vertical plane. The facade's design is unique; it is constructed from porous blocks that define the interior and exterior

spaces and give a sense of movement on a static surface. The facade features different colors on the eastern sides (spring colors) and the western sides (autumn colors) [29].

Fig. 24: Use of colors on the eastern and western facades.

Smart bricks made of reinforced concrete mixed with nanoparticles have been employed. This technology works to clean the air of pollutants and improve the quality of the indoor environment. Additionally, tiles with grooves are used, along with glazing on the sides most exposed to the sun, to reduce the impact of radiation on the thermal comfort of the interior space [30].

Fig. 25: Use of glass to reduce heat effects on facades, in addition to nano-concrete bricks for controlling indoor space comfort.

4.results :

Clay bricks are a traditional building material that has been used since ancient times and continues to be utilized today. They are the primary material in several countries, including Iraq. This research explores the evolution of clay bricks from traditional materials into smart materials with advanced technical properties. The development process involves adding smart elements and technologies aimed at enhancing the strength and durability of the bricks, making them responsive smart materials that can adapt to various conditions and provide optimal comfort within the space. These materials include nanomaterials, carbon fibers, and other substances, each serving different functions depending on their location within the building, The aim of the research is to achieve well-insulated buildings that provide comfortable internal functions and ensure an ideal human environment.

By reviewing examples of the evolution of bricks, the researcher arrives at the results*:*

1. Improved Thermal Insulation: smart bricks, integrating nanomaterials and phase change materials, offer superior thermal insulation over traditional clay bricks, maintaining stable indoor temperatures and reducing the need for heating and cooling.

2. Increased Durability and Strength: Tests revealed that adding carbon fibers and nanomaterials increases the durability and strength of smart bricks, making them more resistant to environmental and mechanical stress, and suitable for various harsh conditions.

3. Intelligent Response to Surrounding Conditions: Smart bricks adapt to environmental conditions due to embedded elements that respond to temperature and humidity changes, enhancing indoor comfort

5. Conclusions:-

1. the thermal brick is considered a traditional construction element used in construction for decades due to its features concerning its capability to temperature regulation and its quality to thermal and sound insulation. But with the development of technology this kind of breaks. Faces some technical issues such as providing a stable indoor environment without any kind of adjustment or control according to external circumstances.

2. The thermal bricks witnessed a lot of transformation through the ages. Thus, it had improved its manufacturing techniques also the traditional construction method. This kind of development led to its latest big leap in brick material, and its function made it more responsive. And adaptive to provide the necessary comfort needed

3. According to the analysis and studies revised for its construction that, there are many kinds of thermal bricks, but the most important element is to provide quality or qualitative control inside. The space is the smart sensor bricks material because it's contributing to improving energy efficiency and sustainability by controlling heat temperature and light also energy continuing automatically according to its surrounding circumstances its should improve the quality of the space by regulating air quality and noise monitoring.

4. Thermal bricks are considered the base element in construction processes and the first step towards the construction of in the mud. Architectural was witnessed because it's row material. The raw material that makes it up is abandoned, has many forms and shapes and can be used easily.

5. We note that despite the rapid development of brick material, it maintains the primary raw materials that make it.

6. The smart brick is considered tougher. And more efficient than the traditional breaks, and that will help speed up the construction process and help in Saving Time energy and comfort in the construction process.

So, the research indicates that the development of thermal breaks to become smart breaks is important. Advisement advancement in the construction field is providing a lot of benefits and forming a sustainable and efficient solution looking forward in the research for further technical and break use improvements in the field.

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