Review on Trendy Advanced Construction Material

Amruta D.Agharde[1], Vishakha R.Hande[2], Krishna R.Dachawar[3], J.A.Kakade4, S.R.Deshmukh[5], A.B.Wakankar[6]
[1,2,3,4,5,6]*Member, Deogiri Institude of Engineering and Management Studies*

***Abstract*: The advanced materials have been developed with intensive research and analysis to solve various issues faced in construction today. Many of them are not yet widely used in the industry but we can expect this to change as the materials become more affordable and accessible. Today the building industry has need for applied research into the performance-in-use of building materials and the products and components made from them. Some materials evolve with time, but others are new to the industry. The need to keep up with demand for housing, disasters, and escalated construction costs created the need for developing new innovative solutions. This Research paper will discuss some of the emerging innovative construction materials.**

***Index Terms*—Advanced Material, Graphene, Timber, Carbon Fibre etc**

I. INTRODUCTION

New Building materials are innovative, enabling the architects to create designs closer to their visions and engineers to build structures in never-before-seen forms and construction techniques. Many of the construction materials we rely on today are made from both nonrenewable and renewable sources. Non-renewable materials pose the risk of depletion sooner or later in the future. Renewable materials fare better although we may end up harming the environment in the process of obtaining these materials from nature. They perform different functions

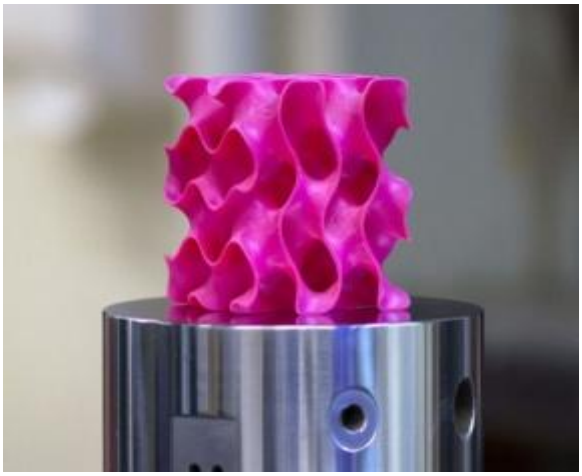
Within each of the building subsystems, materials must satisfy a range of performance criteria. These may be grouped as follows:

i. Structural;
ii. Economic;
iii. Constructional:
iv Fire safety;
v. Less durability;
vi. Environmental.

Advanced Construction Materials For The Future

1. 3D-printed grapheme:

Graphene is a strong, lightweight material used often in microchips and sensors. Several researches have also proved that adding graphene can enhance the strength of a material. Unfortunately, it is expensive and hence, it has not been widely used despite its capabilities. However, researchers have now managed to develop 3D-printed graphene using graphene oxide hydrogel as the resin for the printer. This, however, is not a final product. 3D-printed graphene can be used to reinforce concrete. Trials have begun for the on-site testing of 3D-printed, graphene-reinforced concrete at train stations by UK-based civil engineering company Skanska Costain Strabag JV.



2. Light-generating concrete

Light-generating concrete or cement is non-flammable and able to reflect light, hence the name. This material is also known to absorb solar energy to ‘charge’ and emit light in the dark. Proven to be energy efficient, it has been used to illuminate bicycle lanes and roads in Mexico, where its research took place. As it is quite similar to the regular cement already in use, it can find application in the construction of many other structures like facades and parking lots.

3. Cross-laminated timber (CLT)

Cross-laminated timber is a type of mass timber (man-made or engineered wood) that is binded in layers. As the name suggests, cross-laminated timber is developed in planks by glueing timber pieces in layers, each layer being perpendicular to the previous. CLT is known for its strength as well as for being lightweight. It is easy and quick to construct with CLT since it can be manufactured off-site and assembled on-site. Using CLT alongside technology that provides precise drawings and models, like BIM (Building Information Modelling), can reduce waste and labour needed for construction.

4. Bioplastic

News about plastics causing extensive damage to the environment is hard to miss. Not only do we need to clean them up, we also need to reduce the use of non-biodegradable plastics. A viable solution is bioplastic. Bioplastic is usually made from a plant-based source. When disintegrated, it does not reduce the quality of the soil or harm the environment. Currently, bioplastic is not yet a common construction material but has been used for food containers and smaller household items. The ArboSkin pavilion project by Stuttgart University's ITKE (Institute of Building Structures and Structural Design), built from bioplastic with 90% renewable materials, proves that bioplastic has immense potential as a construction material.

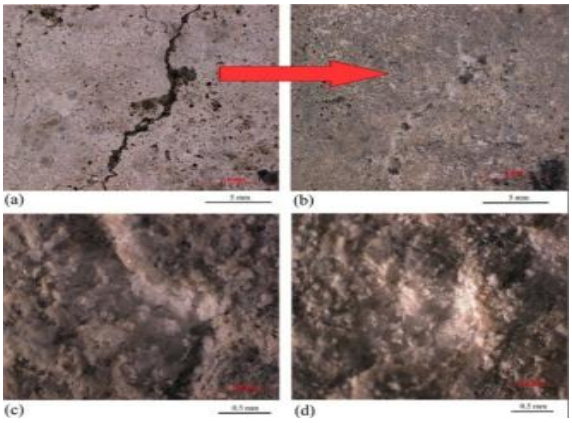
5. Mycelium

Mycelium is the root-like structure of a fungus, and has been a topic of interest for the past few years in the construction industry. Being an organic material, it is compostable and has very little, if any, negative environmental impact, making it one of the most ecologically sustainable materials. Moreover, it is resistant to mould and fire, and has been tested as a source material for bricks.

6. Self-healing materials

We have evolved from using traditional materials such as timber to using concrete as a construction material so frequently that we now live in a concrete jungle. Researchers have been developing the next stage of concrete for construction to counter its vulnerability to cracks. Yes, nothing lasts forever, but with the right materials, we may just be able to extend the lifespan of our built environments. That is, indirectly speaking,

the purpose of self-healing materials including concrete; fibres or natural capsules that release an adhesive substance are added to the concrete mix, which then heals the cracks. For example, TU Delft is developing a prototype of regenerating bio-concrete using a special type of bacteria that, through a series of chemical reactions, restores the cracks in the concrete.



II. LITERATURE REVIEW

Yonatan Ayele Abera[1] investigated that An in-depth review of a varied range of eco-friendly options for construction is done in this thorough research on sustainable building materials. With increased worries about environmental deterioration, the building sector is increasingly focusing on long-term solutions. This research looks into a variety of materials, including bamboo, engineered wood products, recycled composites, and optimal concrete mixtures. The study underlines the importance of compressive, tensile, and flexural strengths, which are a basic feature for structural integrity. The study also gives useful insights into their practical applicability in real-world building projects by assessing the flexural strength of various materials. Furthermore, the study examines the environmental effect of these materials, taking into account characteristics such as renewability, recyclability, and energy efficiency. Laboratory tests were conducted to determine the fundamental properties of selected materials as part of the investigations. The study emphasizes the ecological advantages of adopting these sustainable alternatives through life cycle assessments and comparative studies. The research output can be served as a thorough reference for architects, engineers, and policymakers, providing a complete knowledge of sustainable building materials and their critical role in developing a greener, more resilient built environment.

Ar. Rajeev Parashar [2] investigated that there has been a steady growth of construction in the urban areas of the country. However, some of the backward rural areas receive no such attention in terms of construction. What little construction done is either incomplete or not of the highest quality. This is due to two main limitations: cost of construction and availability of materials. Most of the people living in rural areas are either below poverty line or have very low income. They cannot afford the construction of their house and resort to making kuctcha houses made of mud that is readily available to them. Then there are other select few households which can deal with the construction costs but not quality construction. The pakka houses in the rural areas have no plastering, uses cheap construction techniques which sacrifices on quantity and quality of materials and high maintenance costs. Therefore, these constructions are not much better than the kuctcha house construction. This calls for a building material that combats the two limitations and is effective for construction purposes in rural areas. This study has been undertaken to investigate the effectiveness of Compressed Stabilised Earth Blocks as a building material in central rural India.

Sneha Pradeep [3] This paper investigated that
In the present scenario energy consumption has increased substantially in the buildings, due the materials used some of which have low initial cost but high maintenance cost. Glass is extensively used in buildings to harvest maximum light and to reduce energy consumption for internal lighting requirements. When more natural light enters the building, equal amount of heat also enters the building. If clear glass is used, energy consumption for internal lighting will significantly reduce, but at the same time energy consumption for achieving indoor comfort will be escalated. Similarly, if glazing is not installed in the right orientation, i.e., if larger glazed areas are placed on the east and the west of the building this will lead to rise in indoor temperature of the building and hence more energy consumption to achieve ambient indoor temperature. In this report, a study has been attempted to understand the effective use of glazing in different climatic zones of India. As per Energy Conservation

Building Code (ECBC) India is divided into five different climatic zones. With the help of case studies from five different climatic zones, suitable locations for placement of glazing have been analyzed. The study also includes effective use of various glazing systems, like double / triple glazing, gas filled glazing, low- emissivity coating, heat absorbing tints, etc. in reducing energy consumption and enhancing the occupants' comfort level and their productivity.

III. REMARKS ON LITERATURE REVIEW

A. The research output can be served as a thorough reference for architects, engineers, and policymakers, providing a complete knowledge of sustainable building materials
B. This study has been undertaken to investigate the effectiveness of Compressed Stabilised Earth Blocks as a building material in central rural India.
C. The study also includes effective use of various glazing systems, like double / triple glazing, gas filled glazing, low- emissivity coating, heat absorbing tints, etc. in reducing energy consumption and enhancing the occupants' comfort level and their productivity.

ACKNOWLEDGMENT

I like to express sincere thanks to my Guide Dr.R.V.Pakhale Sir and Co-Auther A.B. WakankarSir, Mr.K.R.Dachawar and V.R.Hande for giving me valuable suggestions and ideas.I also thanks my department to give me moral support.

REFERENCE

[1] Yonatan Ayele Abera,“ *Sustainable building materials: A comprehensive study on eco-friendly alternatives for construction”.* Composites and Advanced Materials Volume 33: 1–17

[2] Ar. Rajeev Parashar B,“ *Alternative Building Material For Incentivize Contemporary Vernacular Architecture”* January 2018 | IJIRT | Volume 4 Issue 8 | ISSN: 2349-6002

[3] Sneha Pradeep1, Pradeep H R2, Babitharani H. “*Use of High-Performance Glass as a Sustainable Building Material*. | IJIRT | Volume 6 Issue 2 | ISSN: 2349-6002.