PRODUCTION AND THERMAL ANALYSIS OF COMPOSITE BRICK BY ANSYS APPROCH

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Abstract: It is very difficult to calculate and analyses with precision the thermal behaviour of the walls of different materials attached to each other. The study of composite materials thermal behaviour is useful for the determination of heat transfer rate and heat flux. These composite materials which can be implemented to many applications such as thermal ventilations, Insulators, metallic multiwall thermal protection systems, etc. In this study we are going to analyses the thermal behaviour of two composites. For finding heat flux and heat flow rate the finite element program ANSYS is used. The experimental test is carried out for heat flux and heat flow rate of composite materials. Experimental Results are compared with the finite element ANSYS results and the validation is done.

IndexTerms - Thermal conductivity, Composite materials, Heat flux, Conduction, Heat Flow

I. INTRODUCTION

Bison Panel has innumerable applications - it can be used in all places where an ordinary particle board can be used. For example, Bison can be used for wall partitions, false ceilings, doors, wall claddings, flooring, kitchen platforms, table tops, stair cases, louvers, cabinets, cabins, & many more. The boards are fire, water, weather, termite, & vermin resistant, & achieve both dimensional & chemical stability over a long construction period. Bison Panel confirms to I.S.O. 8335 / 1987 (International Standards Organization) & I.S. 14276 / 1995. Further, Bison can be used for the construction of fire resistant building elements to satisfy the criteria of I.S.O. 834-1975 & I.S. 3809 - 1979 for 1/2 hour to 4 hours fire rating. Bison is ecofriendly with IGBC certificate & GRIHA / SVAGRIHA compliance. Bison Panel is a cement bonded particle board made out of 62% cement & 28% wood. The wood used is of fast-growing species like Eucalyptus & Poplar. Due to adoption of a special manufacturing process, the panel acquires the strength & durability of cement, & the easy workability of wood - a combination of qualities absent in other boards. Bison Panel is highly fire resistant & has been classified as an incombustible material in many countries around the globe. Tested in accordance with BS 476 - Fire test on building materials & structures, Parts 6, 7 have classified it as a class 'O' building board with class I surface spread of flame. Bison can be used for the construction of fire resistant building elements to satisfy the criteria of I.S.O. 834 - 1975 & I.S. 3809 - 1979 for 1/2 hour to 4 hours fire rating. With cement constituting 62% of its composition, Bison offers excellent resistance to weather. The board has been subjected to many cycles of soaking, freezing, & heating without any sign of disintegration. The board should generally be painted or for external applications to provide a weather seal. Air borne sound reduction varies between 30 & 37 db for the frequency range 100 - 3150 Hz according to the thickness of Bison Panel. When used in stud partitioning, a reduction of over 60 db can be achieved with suitable construction. Bison has excellent dimensional stability in variable ambient temperatures & humidity conditions. The swelling in thickness after 2 hours of immersion in water is 1% & after 24 hours immersion is only 1.5%. Longitudinal & transverse swelling will be approximately 0.3% for change in relative humidity of air from 30% to 95% at 20 deg C.

II. MATERIALS AND METHODS

Preparation of clay for bricks manufacturing is done in six steps: Un- soiling of clay we need pure clay for the preparation of bricks. The top layer of soil may contain impurities, so the clay in top layer of soil about 200mm depth is thrown away. This is

called un-soiling. Digging After the removal of top layer, the clay is dug out from the ground and spread on the plain ground. Cleaning In this stage, the clay is cleaned of stones, vegetable matter etc. if large quantity of particulate matter is present, and then the clay is washed and screened. The lumps of clay are converted into powder with earth crushing rollers. Weathering the cleaned clay is exposed to atmosphere for softening. The period of weathering may be 3 to 4 weeks or a full rainy season. Generally, the clay is dug out just before the rainy season for larger projects. Blending if we want to add any ingredient to the clay, it is to be added in this stage by making the clay loose and spread the ingredient over it. Then take small portion of clay into the hands and tuning it up and down in vertical direction. This process is called blending of clay. Tempering In this stage, water is added to clay and pressed or mixed. The pressing will be done by cattle or with feet of men for small scale projects, pug mill is used as grinder for large scale projects. So, the clay obtains the plastic nature and now it is suitable for moulding.

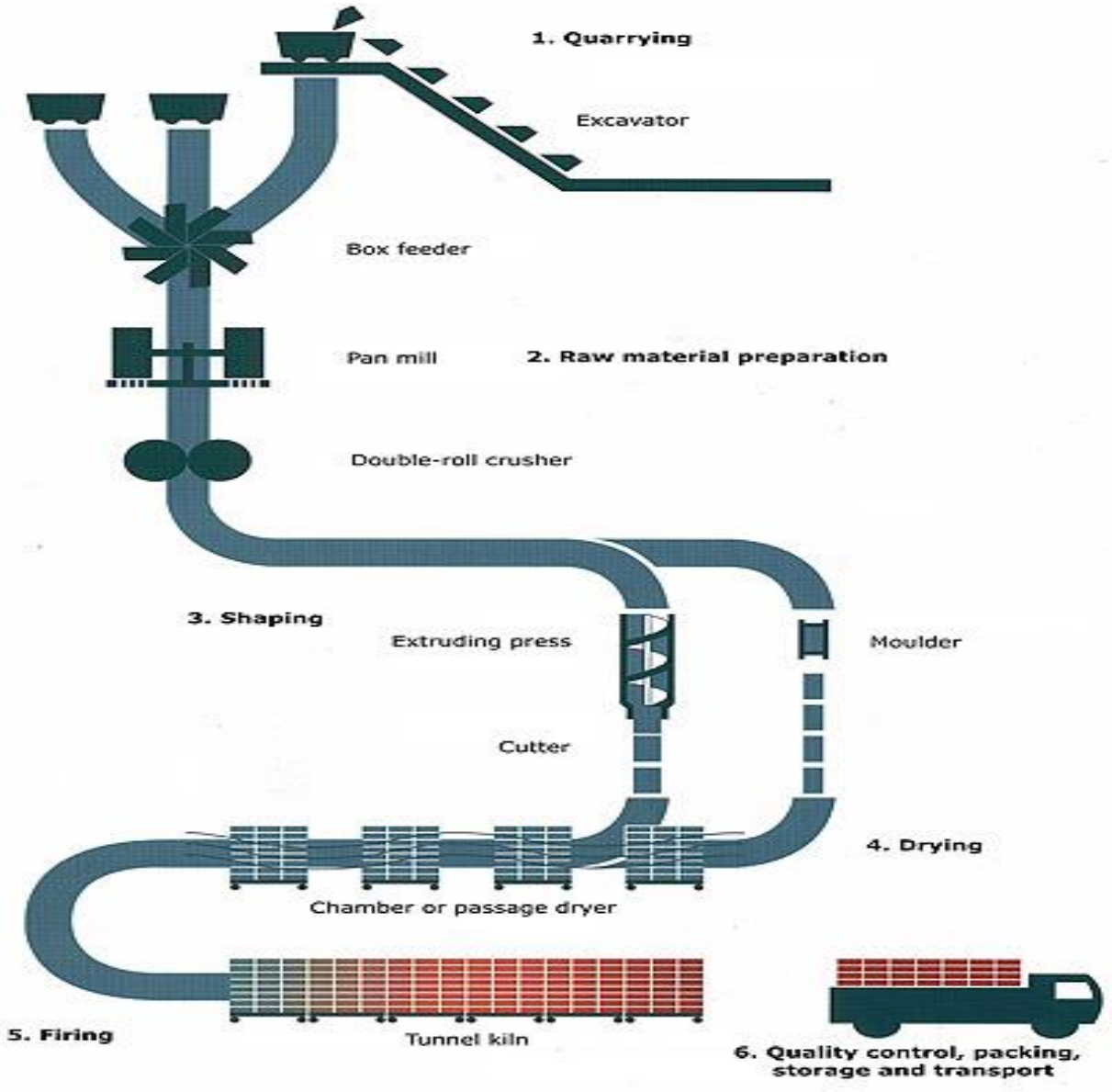

Fig.1.Raw materials and manufacturing procedure of composite brick

III. RESULTS AND DISCUSSION

Ansys design simulation

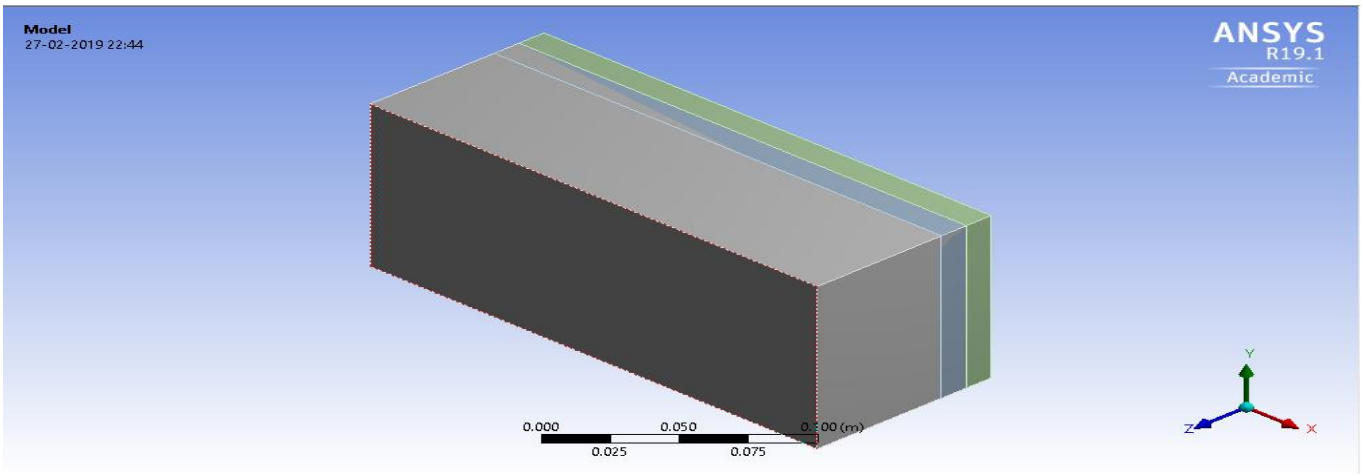

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Fig.2.Ansys design model

S.no	material	Thermal conductivity (W/mK)
1	Composite Brick	0.25
2	Plaster of Paris	0.051
3	White cement	0.086

Table.1. Materials and object selection

ANSYS Meshing

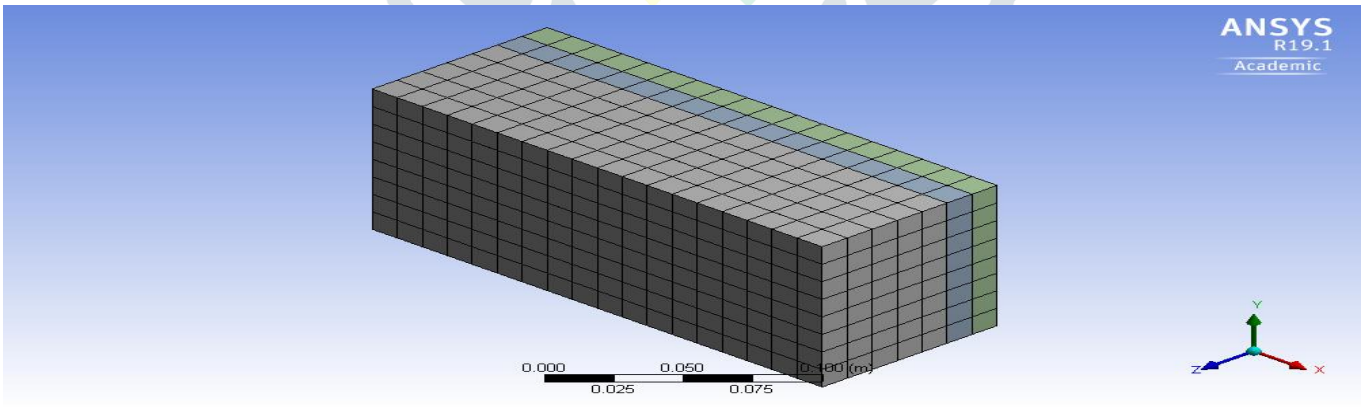


Fig.3.Meshed part

Creating the most appropriate mesh is the foundation of engineering simulations. ANSYS Meshing is aware of the type of solutions that will be used in the project and has the appropriate criteria to create the best suited mesh. ANSYS Meshing is automatically integrated with each solver within the ANSYS Workbench environment. For a quick analysis or for the new and infrequent user, a usable mesh can be created with one click of the mouse. ANSYS Meshing chooses the most appropriate options based on the analysis type and the geometry of the model. Especially convenient is the ability of ANSYS Meshing to

automatically take advantage of the available cores in the computer to use parallel processing and thus significantly reduce the time to create a mesh.

Ansys input values

Film coefficient = 10 W/m^2.deg C

Temperature applied on wall = 250 deg C

Initial temperature = 21 deg C

Heat transfer mode = steady-state thermal (Convection)

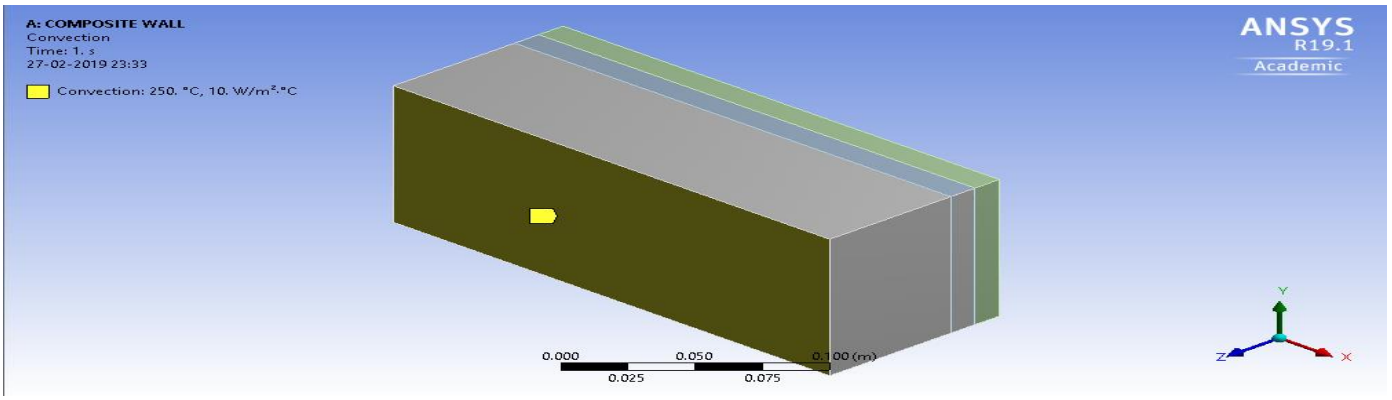


Fig.4.Convection setup

Temperature distribution in composite brick wall

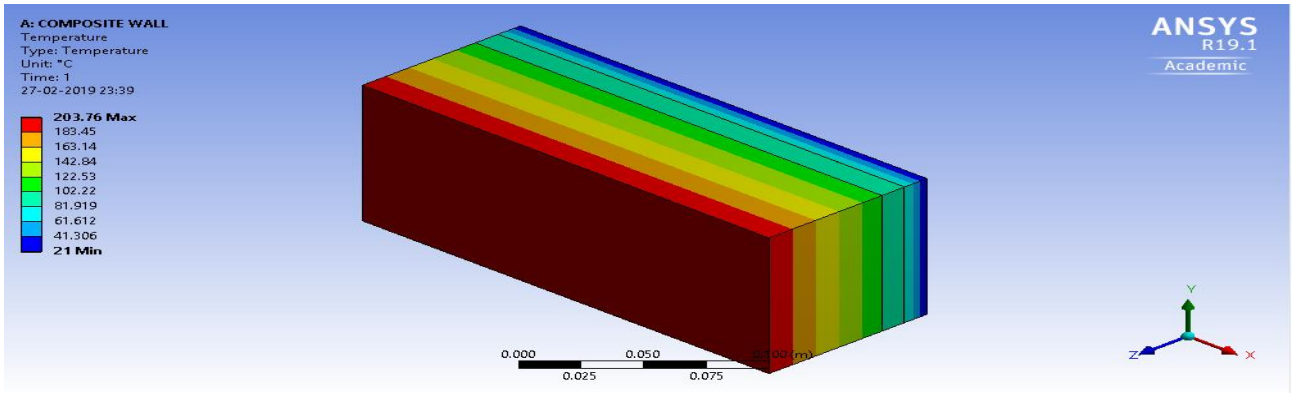


Fig.5. Temperature distribution

Total heat flux

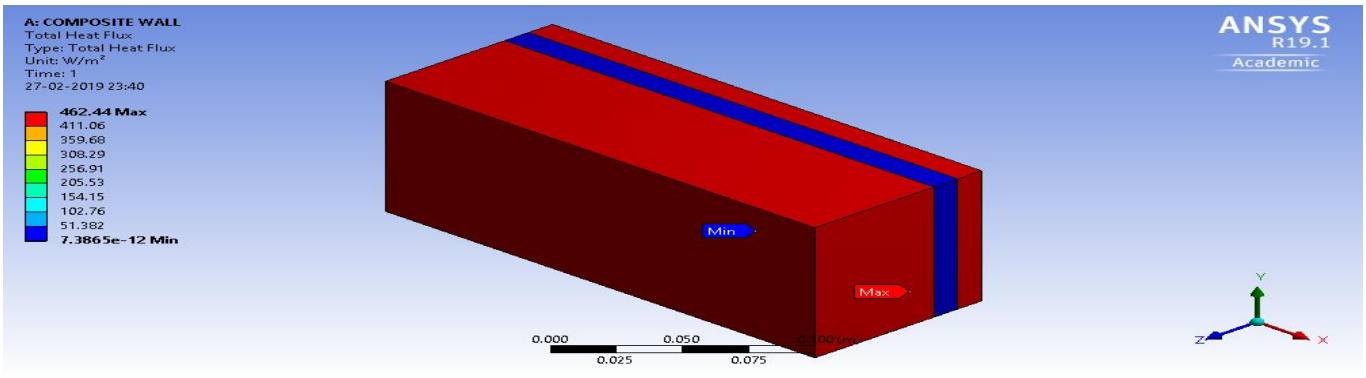


Fig.6. Total heat flux distribution

Temperature at different nodes

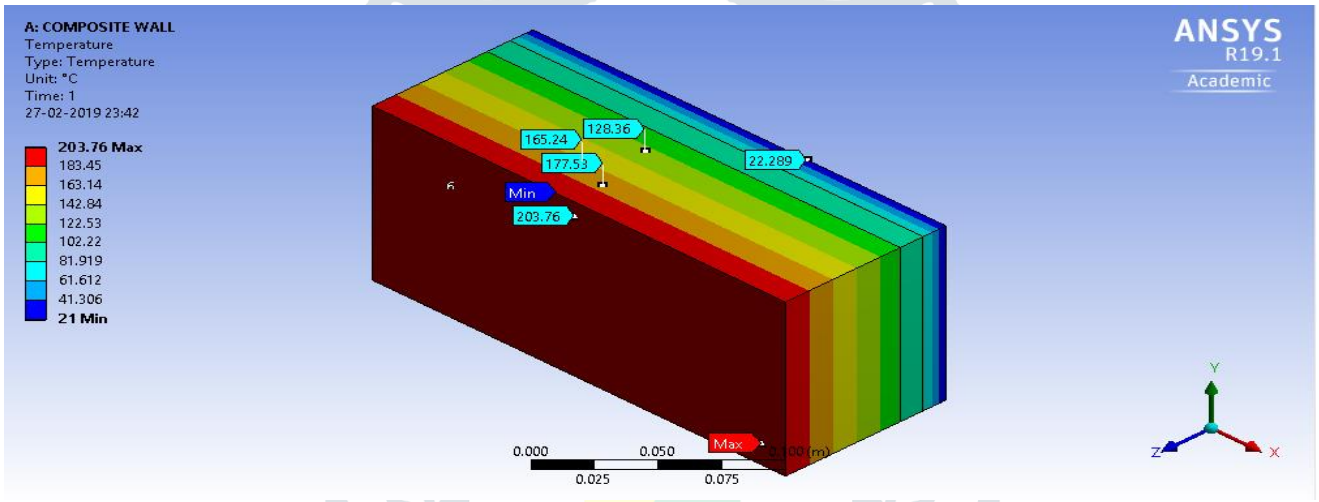
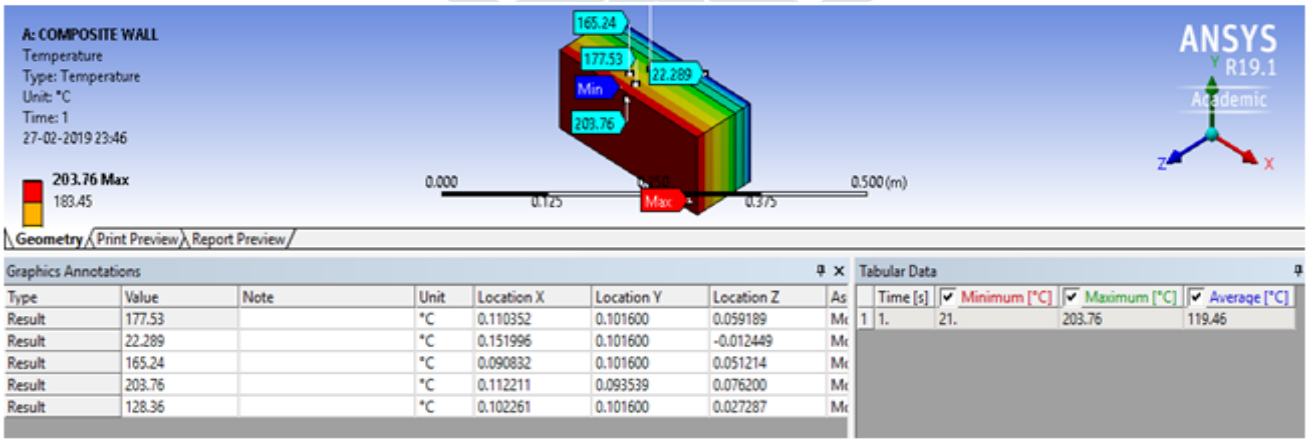


Fig.7. Temperature distribution

Temperature values



Type	Value	Note	Unit	Location X	Location Y	Location Z	As
Result	177.53		°C	0.110352	0.101600	0.059189	Ma
Result	22.289		°C	0.151996	0.101600	-0.012449	Ma
Result	165.24		°C	0.090832	0.101600	0.051214	Ma
Result	203.76		°C	0.112211	0.093539	0.076200	Ma
Result	128.36		°C	0.102261	0.101600	0.027287	Ma

	Time [s]	Minimum [°C]	Maximum [°C]	Average [°C]
1	1.	21.	203.76	119.46

Fig.8. Temperature values

CONCLUSION

Temperature inside the room 21 deg C ,Temperature input to brick surface 250 deg C, Maximum temperature 203 deg C and average initial temperature before the POP layer 26.723 deg C . Thermal analysis is carried out to observe temperature

distribution pattern in brick at various time steps. After conducting thermal analysis, it is observed that temperature distribution is linear. Finally, by FEA simulation in ANSYS .we understand stress distribution, deformation and temperature distribution in composite brick. Temperature distribution along thickness of brick is observed at various temperature ranges.

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