iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VIII **Month of publication:** August 2020

DOI: https://doi.org/10.22214/ijraset.2020.31276

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VIII Aug 2020- Available at www.ijraset.com

Experimental Study on the Thermal & Sound Absorption Performance of Mixed (Jute, Coir & Bamboo) Natural Fiber Reinforced Epoxy Composite

Mahesh Kumar[1], Om Prakash[2] Preetam Kumar Patel[3]
[1]*M.Tech student, Thermal Engineering, Government Engineering College Jagdalpur, Chhattisgarh, India.*
[2]*Assistant Professor, Department of Mechanical Engineering, Government Engineering College Jagdalpur, Chhattisgarh, India.*
[3]*M.Tech student, Thermal Engineering, Government Engineering College Jagdalpur, Chhattisgarh, India.*

Abstract: ***This study works primarily issues the handling and characterization of the epoxy composites reinforced with combination of mixed (jute, coir & bamboo) natural fiber. The effective thermal conductivity and the sound absorption coefficient of the epoxy reinforced with combination of mixed natural fiber are experimentally investigated by consuming the jute, coir & bamboo fiber within the production of the thermal resistance and sound-absorbing material by using an easy manual made up system.***
The Thermal conductivity are calculated through the Model 2022 Unitherm TM testing machine through the ASTME-1530 standard & the Absorption coefficient values are calculated by an impedance test tube machine. According to the readings estimate, the reinforcement of the combination of mixed natural fiber produces a decrease the thermal conductivity of the epoxy and rises the coefficient of sound absorption by means of increasing the weight segment of the mixed natural fiber. With a rising in thermal isolation and sound absorption capability, those reinforced epoxy gums can discovered their function inside the insulation of walls, in meals boxes, and in various similar packages of thermal and sound protection.
Keywords: Sound absorption coefficient (α), mixed natural fiber, Effective Thermal Conductivity coefficient (K eff).

I. INTRODUCTION

These days, increase in sustainability and environmental concerns have evoked the interest in research and development of high performance and biodegradable composite. Efforts have been made to develop natural fibers and particulate reinforced composites as it is one of the most effective ways to satisfy the “eco-material” concept which serve as a basis to sustain the environment. One of the alternatives solution that attracts interest is utilization of abundantly natural fiber as reinforced materials in polymer matrix composite.

The improvements in composite material resulting to meeting the difficulties of aeronautics section have fell down for considering nearby similarly as present day applications. Composites, the miracle solid with lower mass, higher solidarity to-weight extent and solidness properties have gained significant ground in displacing the conventional materials like metals, wood, etc. The material analysts wherever all through the world focused on standard composites invigorated with Jute, Bamboo, Sisal, Pineapple, Coir, Bagasse etc. basically to cut down the expense of raw materials.

Composite is hybrid material which consists of two or more chemically distinct constituents. There is continuous phase which created by matrix and embedded by discontinuous phase, the reinforcement medium. The matrix phase is usually made up from fundamental material such as metals, ceramics and polymers. Meanwhile, the reinforcing phase is widely in the form of fibers, whiskers and particulates.

A. Requirement of Thermal Insulation

The aim of thermal insulation, primarily in the construction and making of houses, is to keep a fresh and pleasant climate in the event of excessive heats or to keep heat in the event of comfortable conditions by slowing down the heat flow with the help of the means of isolation.

©IJRASET: All Rights are Reserved

B. Requirement of Acoustic Insulation

Sound protection is the avoidance of acoustic vitality or waves that are sent from one side of the structure divider to another. In this quickly developing current world, the extension of electrical, electronic and Mechanical gadgets in residential and business organizations, ventures have centered the issue of sound Pollution produced by them.

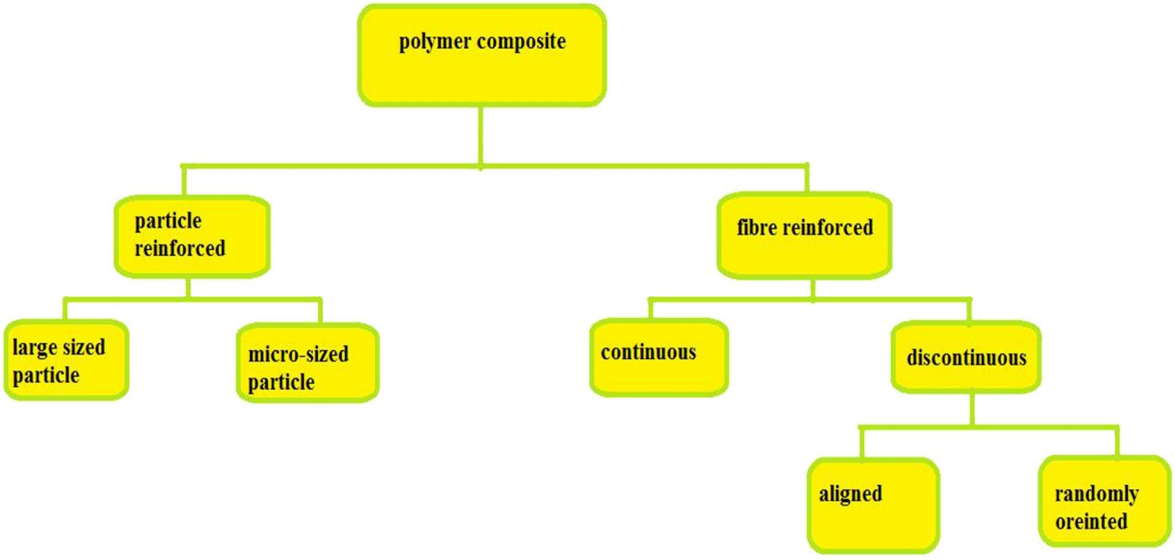


Figure.1 Types of composites

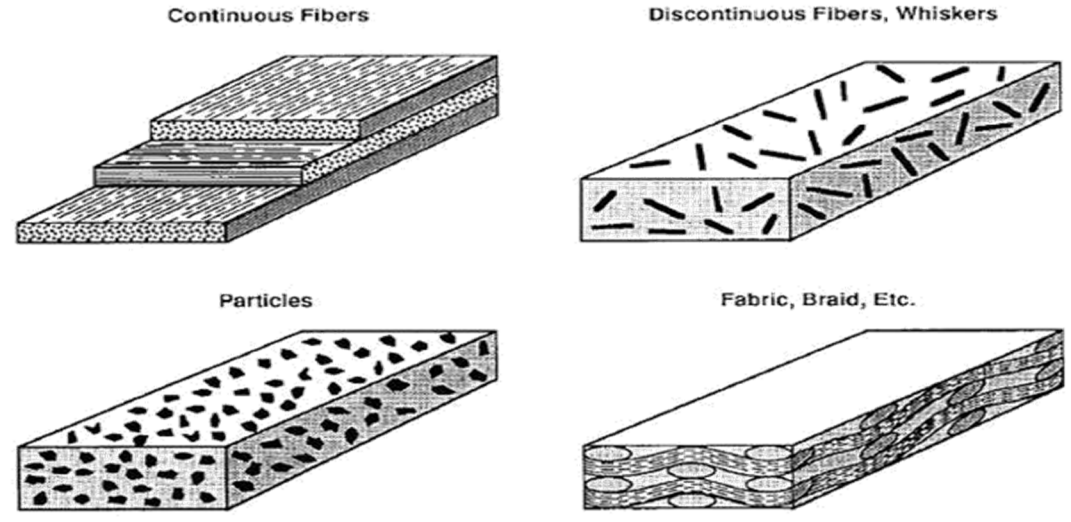


Figure.2 Types of reinforcement

II. RELATED WORK

Yamamoto et al. [1]. It was discovered that thermal conductivity of the misleadingly functionalized graphite/epoxy composite with such stripped graphite (20wt %) extended from 0.2 to 5.8 W/m-K. Carbon fiber, regularly fume created carbon fiber (VGCF), is a basic carbon-based filler. Murali Mohan Rao et al. [2] Studies coordinated on balanced thermal conductivity of polymer composites stacked with carbon nanotubes have starting late been researched by Qureshi et al. [3]. Krishna & Sushanta et al. [4-5]. Segments other than the inherent warm conductivity of the fillers, for instance, shape, size, flow and interconnectivity between the particles moreover pick the composite warm conductivity. Sanjay Singh et al. [6] focused on the effect of two particular atom sizes of aluminum filler and found that the composite stacked with greater particle size shows essentially high warm conductivity.

©IJRASET: All Rights are Reserved

It is a direct result of the improvement of all the more consistent thermally conductive pathways in the structure material. Similar direct was seen by Youssef Habibi et al. [7]. Regardless of what may be normal, a couple of essayists have featured the higher warmth transport limit of the composites stacked with humbler particles Bindu & Sabu Thomas et al. [8, 9]. Sreekumar et al. [10] exorbitantly investigated various roads with respect to copper powders instead of aluminum and found better warm conductivity with particles. Lewis et al. [11] investigated the sound Characteristics of bamboo fiber, which was discovered about equivalent to sound retention of glass fleece. Kumlutas et al. [12] chipped away at rice straw-wood molecule board to supplant wood. An assessment was done based on modern made compressed wood which was additionally broke down. It is uncovered that the wood molecule of rice straw having lower explicit gravity which gives upgraded sound ingestion inside the scope of 1-8 kHz when contrasted with both compressed wood board just as fiber board. Bruggeman et al. [13] chipped away at kenaf fiber in reverberation corridor, the results were practically identical with old engineered sound safeguards. The outcomes are not sufficient however on the off chance that the results on condition is considered, at that point it is similarly acceptable. Maxwell et al. [14] played out a test on acoustic pannel comprised of wheat and grain straws.

III. METHODOLOGY

The manufacture after mixed (jute, coir & bamboo) natural fiber keen on a curved composite examples are divided into 2 phases, which are additionally utilized in place of estimating the thermal conductivity, mechanical property and acoustic absorption coefficient. First step is the pre action step and second is Manufacture organize. In the first step, mixed (jute, coir & bamboo) natural fiber was changed keen on 3-4 mm size. At that point they were dehydrated below sun for approx. 15days and additional warmed in the heater at 85 ºC for in any event 10 minutes, with the goal that the overabundance dampness in the fiber gets dissipated. In the planning step, the mixed fiber is blended in 5 various weight division with the epoxy gum mixing with hardener The Polymer matrix composite blended in with mixed natural fiber and thereafter 5 tests are made by clear hand made up system. Epoxy pitch regenerated at the Low temperature is taken as a system material which is then blended in with the hardener. These both must be blended in the extent of 3:1 by weight as permitted. The blended (epoxy stacked up with fiber) is then carefully cleansed into the barrel made glass to acquire the composite model having plate shape. By then finally the semi liquid manufactures are preserved at possibility temperature for around 36 hours to encounter complete polymerization, at long last the glass casts are damaged to develop the models for additional testing of test to get sound ingestion coefficient, mechanical property and thermal conductivity tests are set up concurring the overhead framework through different natural fiber weight segment.

Figure.3 Natural fiber composite

©IJRASET: All Rights are Reserved

IV. RESULTS

Table 1 Change of thermal conductivity through different mixed natural fiber weight segment

Serial No.	Weight fraction (gm)	K eff (W/m K)
1	0gm	0.49
2	1gm	0.25
3	2gm	0.11
4	3gm	0.036
5	4gm	0.017

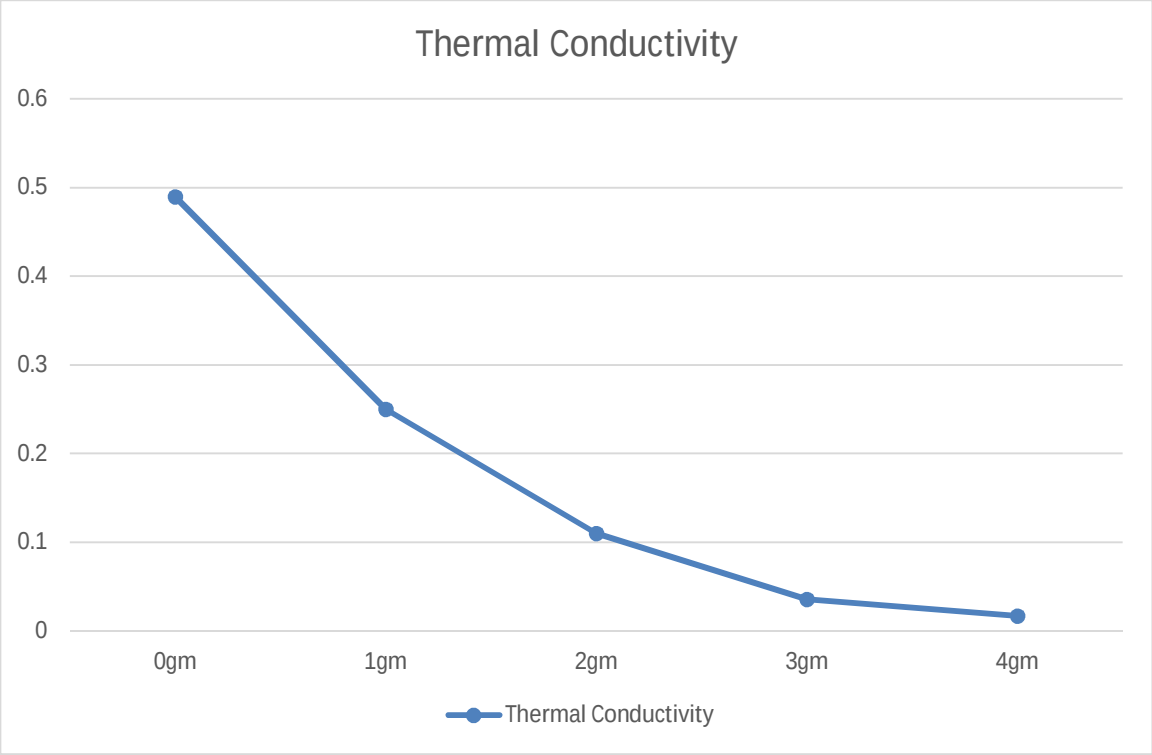


Figure.4 Change of thermal conductivity through different mixed natural fiber weight segment

Table.2 Change of absorption coefficient at various frequencies

S. No.	Weight Segment (gm)	Absorption Coefficient ( )							
		500(Hz)	1000(Hz)	1500(Hz)	2000(Hz)	2500(Hz)	3000(Hz)	3500(Hz)	4000(Hz)
1	0gm	0.178	0.183	0.199	0.277	0.353	0.613	0.613	0.670
2	1gm	0.263	0.294	0.311	0.370	0.457	0.638	0.651	0.681
3	2gm	0.293	0.297	0.322	0.397	0.481	0.611	0.673	0.713
4	3gm	0.312	0.334	0.398	0.416	0.498	0.689	0.731	0.778
5	4gm	0.371	0.397	0.413	0.498	0.587	0.737	0.793	0.796

©IJRASET: All Rights are Reserved

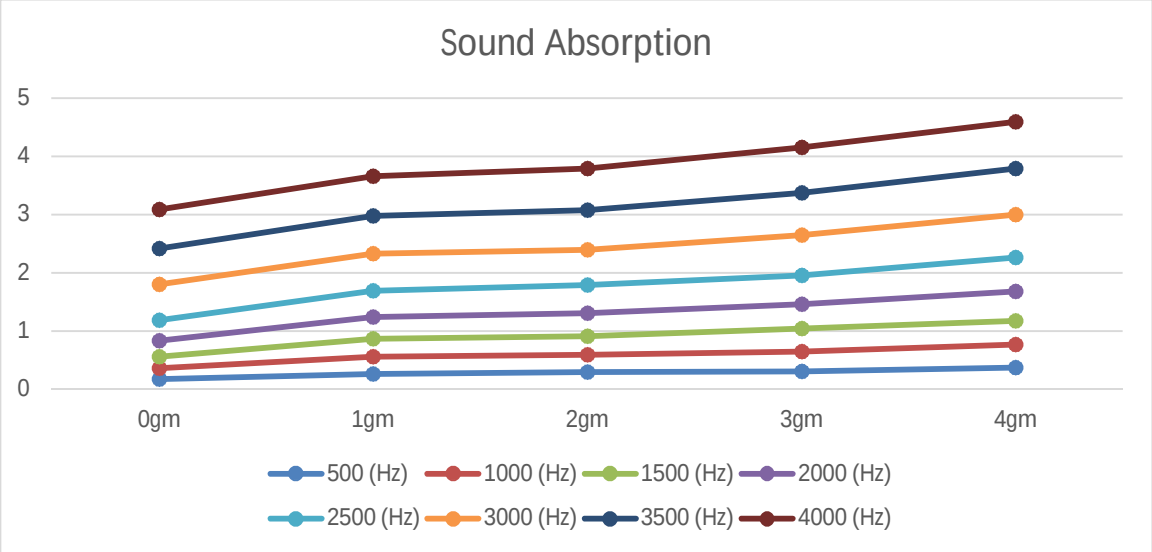


Figure.5 Change of absorption coefficient at various frequencies

V. CONCLUSION

A. Successful fabrication of mixed (jute, coir & bamboo) natural fiber reinforced epoxy composites are promising by simple hand made up system.

B. By adding the mixed natural fiber, thermal conductivity is remarkably reduced.

C. By adding the mixed natural fiber, sound absorption coefficient is remarkably improved.

D. It is established that the outcomes acquired by adding of 0gm, 1gm, 2gm, 3gm and 4gm the thermal conductivity decreased 18.3%, 33.9%, 59.7% and 85.3% correspondingly.

E. It is established that the outcomes acquired by adding of 0gm, 1gm, 2gm, 3gm and 4gm, the absorption coefficient is increased.

REFERENCES

[1] Yamamoto I., Higashihara T. and Kobayashi T. (2003), “Effect of silica-particle characteristics on impact/usual fatigue properties and evaluation of thermal characteristics of silica-particle epoxy resins”, The Japan Society of Mechanical Engineers Int Journal.,V.46(2), pp. 145–153.

[2] Murali Mohan Rao, K. and Mohana Rao, K. “Extraction and thermal Properties of Natural Fibers: Vakka, Date and Bamboo”, J. Compos Struct, Vol. 77, pp.288-295, 2007.

[3] Al-Qureshi, H.A. “The Use of Banana Fiber Reinforced Composites for the Development of a Truck Body”, in Proc. 2ndInternational wood and natural fiber composite symposium, 1999.

[4] Kristiina Oksman, Aji P. Mathew, Runner Langstrom, Brigitha Nystrom And Kuruvilla Joseph,“The Influence Of Fiber Microstructure On Fiber Breakage And Mechanical Properties Of Natural Fiber Reinforced Poplypropylene” , Compos Sci Tecnol, Vol 69, Pp. 1874-1853,2009.

[5] Sushanta K. Samal, Smita Mohanty and Sanjay K. Nayak, “Banana/Glass Fiber Reinforced Polypropylene Hybrid Composites: Fabrication and Performance Evaluation”, Polym Plast Technol Eng, Vol. 48, No. 4, Pp. 397-414, 2009.

[6] Sanjay Chattopadhyay, Sanjay Singh, Nilay Pramanik, Niyogi, U.K., Khandal, R.K. RamagopalUppaluri And Aloke K. Ghoshal, “Biodegradability Studies On Natural Fibers Reinforced Polypropylene Composites” , J. Appl Polym Sci, Vol. 121, Pp. 2226-2232, 2011.

[7] Youssef Habibi, Waleed K. El-Zawawy, Maha M. Ibrehim and Alian Dufresne, “Processing and Characterization of Reinforced Egyptian Agro-Industrial Residues”. Compos Sci Tecnol, Vol. 68, Pp. 1877-1885, 2008.

[8] Anshida Haneefa, Panampilly Bindu, Indose Aravimd and Sabu Thomas, “Studies on Tensile and Flexural Properties of Short Banana/ Glass Hybrid Fiber Reinforced PolystyreneComposites”, J. Compos Mater, Vol.42, Pp. 1471-1489, 2008.

[9] Laly Pothan, Sabu Thomas and Neelakantan, N.R. “Short Banana Fiber Reinforced PolyesterComposites: Mechanical, Failure and Aging Characteristics”, J. Reinf Plast Compos, Vol. 16, pp.744-765, 1997.

[10] Sreekumar, P. A., Pradeesh Albert, Unnikrishnam, G., Kuruvilla Joseph and Sabu Thomas, “Mechanical and Water Sorption Studied of Ecofriendly Banana Fiber-Reinforced Polyester Composites Fabricated by RTM”, J. Appl Polym Sci, Vol. 109, pp. 1547-1555, 2008.

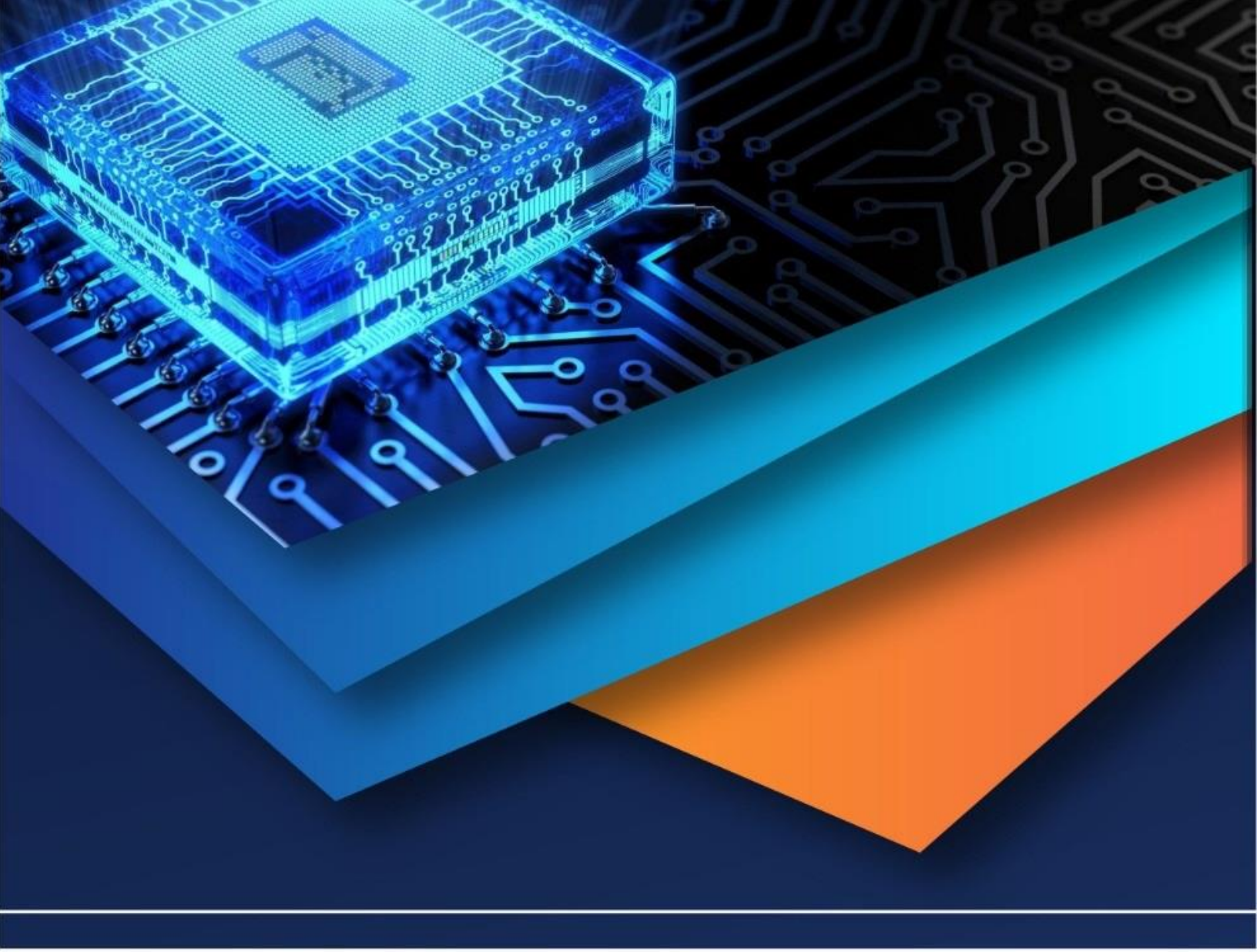
[11] Lewis T., Nielsen L., (1973) Thermal conductivity of particulate-filled polymers, Journal of Applied Polymer Science, Vol. 29, pp 3819–3825.

[12] Kumlutas D., Tavman I. H., Coban M.T., (2003), Thermal Conductivity of Particle Filled Polyethylene Composite Materials, Composites Science and Technology, 63(1), pp 113–117.

[13] Bruggeman D.A.G. (1935), the calculation of various physical constants of heterogenous Substances. i.e, the dielectric constants and conductivities of mixtures composed of isotropic Substances, Annalen der Physik (Leipzig), 24, pp 636-64.

[14] Maxwell J.C. (1954), a treatise on electricity and magnetism, 3rded. New York: Dover, 2, pp 263-269.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)