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Smart Materials - A Review on Smart Material

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Abstract: ***This review paper was describe the smart material and their application of the smart material and also describe the smart sensing Technology. A wide range of smart material like piezoelectric, MR materials, ER Material, SMA, etc This smart sensing technologies using for a smart building material are efficient for the construction. The advantages of this material possess to use in special areas such as vibration control, high dynamic system for instance. There are various applications for the Field of Defence and Space, Nuclear Industries, Biomedical Applications, Carbon fiber reinforced concrete.***
Keywords: Sensors, Shape memory alloy, Smart materials

I. INTRODUCTIVE LITERATURE SURVEY

A. Prof. Parihar et.al

In this paper was describe the smart material and their application of smart materials. A extensive range of smart building material in which include piezoelectric materials, MR materials, ER materials and SMA etc. Inside together ER&MR fluid, To change their fluid properties such as viscosity can be manipulate by vary an electric supply and by vary the strength of a electric field, The particle modify can be align in among the electrodes. In the automotive/aerospace industry have been used for the initially first time for these smart materials for different applications. The following properties of smart material are Sensing material and devices, Actuation material and devices, Control devices and Techniques, Self detection and Self diagnostic, Self corrective, Self controlled, Self healing, Shock absorber arrest. Understanding / Controlling the composition of any new material are ultimate objectives. Advanced material will definitely enhanced the quality of our life.

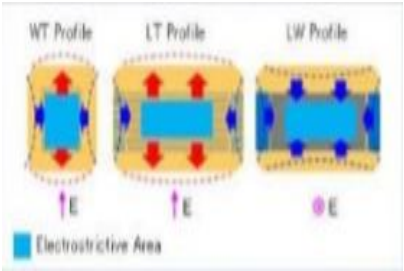


Fig. 1: Electrostrictive material, Prof. (Parihar et.al, 2016)



Fig. 2: Electro chromic material, (Prof. Parihar et.al, 2016)

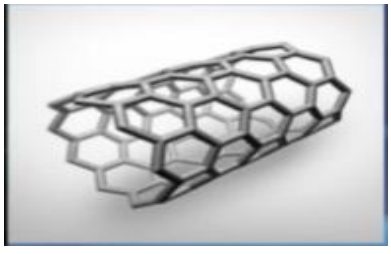


Fig. 3: Fullerences, Prof. (Parihar et.al, 2016)

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Fig. 4: Biomimetic materials, (Prof. Parihar et.al,2016)

B. Juhi Mishra

In this study are focus for the smart material overview and also the present and the potential application in various field. For a brief discussion about such type actuators, SMA and piezoelectric material. The basic concept of smart material is useful to differentiate the various material and also used for a new technology. Some of the major field of application of smart material are–

1) Aeronautics- In aircraft or automotive structure to reduce the vibration we use the Piezoelectric actuators
2) Structural health monitoring- Embedding smart material with in structures to monitor the damage and stress and also can be reduce the repairing cost and increase their life
3) Nuclear industries- In nuclear field from enhancing safety measures to the personal exposure reduction life cycle cost reduction and performance improvement
4) Civil Engineering- It is able to detect the cracks in concrete structure , vibration of the tall buildings
5) Medical field- In medical field research for artificial muscle application, Polyelectrolyte gels are being experimented
6) Reducing waste- In smart material can be help to automate this process can recyclable waste easily separable.



Fig. 5: Smart material, (Juhi Mishra, 2017)

C. J. Gopi Krishna, J. R. Thirumal

In this research paper to describe the various types of the smart materials. Sensing technology parts of the smart material. FOS, SC and Smart structure for the seismic. This technology is useful for the new and present constructions activity. The following advantages of the smart material such as less time consuming, Response of a structure can monitor in real time and also monitored the performance of a composite materials. The following features of smart material and structures –

The majority of the research focused on the intelligent civil structure has been in two areas -

1) Identification of structures behaviour or properties (For example – deformation energy usages, damage evaluation etc.)
2) Control of structural response (For example – Wind, Earthquake)

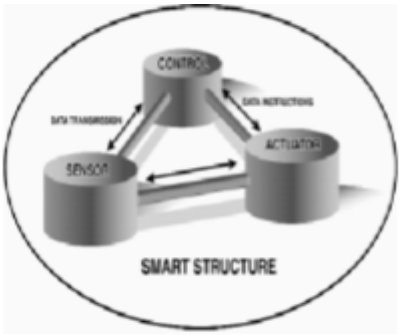


Fig. 6: Component of the smart material, (J.Gopi Krishna, J.R.Thirumal, 2015)

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D. Shailendra Kumar Bohidar et.al

In this research study the overview of the smart technology and describe a smart structure and their components, some examples. This is a part of work are useful for the engineering applications. There are various types of the sensors and actuators to measure the system component. Some of the application smart material is –

1) Structural health monitoring.
2) Self – repair.
3) Field of defense and space.
4) Nuclear industries.
5) Structural Engineering.
6) Biomedical application
7) Reducing Waste
8) Reducing food waste
9) Health
10) Ageing Population



Fig. 7: Application of smart system, (Shailendra Kumar Bohidar et.al, 2015)

E. H. P. Monner

In this study to focus for a commercially available and latest smart materials with the particular case for active noise/vibration reduction tasks. It consider for a large magnetic field and required a relative heavy/voluminous electromagnets. Their some limitation in actuators stroke for a active noise and vibration reduction tasks.

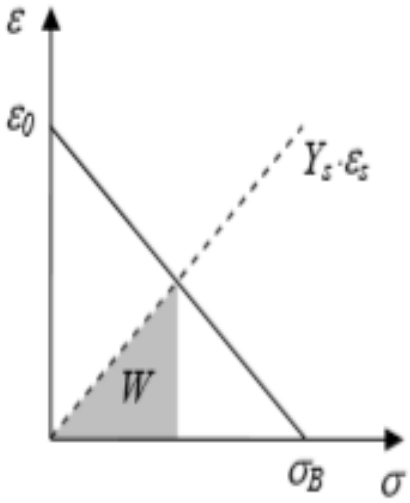


Fig. 8: Stress–strain characteristics of smart material, (H. P. Monner, 2005)

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Fig. 9: Stack actuators, (H. P. Monner, 2005)

F. Prince Kumar Sharma et.al

This paper shows the capabilities and application of the smart materials. Smart materials have some special physical properties that changes with the response like a temperature electric/ magnetic field, stress. Certain properties are far beyond to the conventional actuation system. The advantages of these material possess to use in special areas such as vibration control, high dynamic system for instance. There are various application -In the Field of Defence and Space, In Nuclear Industries, Biomedical Applications, Carbon fibre reinforced concrete.

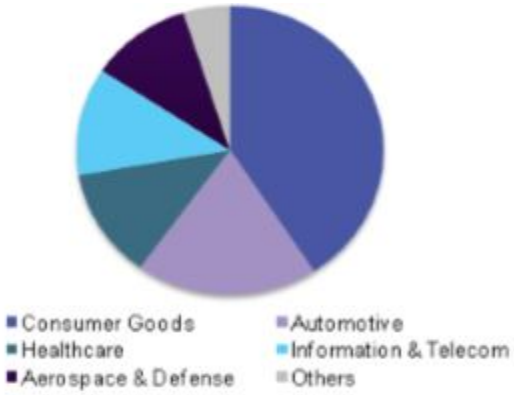


Fig. 10: Piezoelectric material consumption, (Prince Kumar Sharma et.al, 2019)

G. Bhushan Mahajan, Sushil Chopde, Sunil Yadav

The main objective of this studies to brief application and also future scope of the smart materials. Introduce the properties of the smart materials. In the current year smart materials is the most important field. There is various challenges in vibrations, bionics, defence, aerospace/medical sectors. This is way to describe the concept of the smart material and their uses.

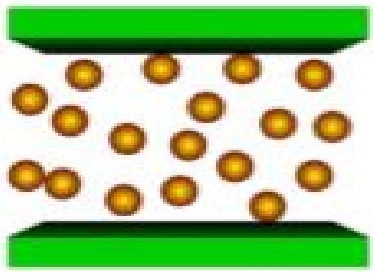


Fig. 11: Working of MR Fluid, (Bhushan Mahajan, Sushil Chopde, Sunil Yadav, 2018)

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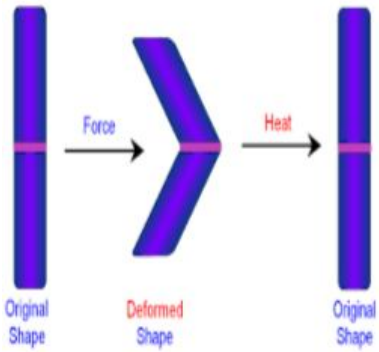


Fig. 12: Shape memory alloy, (Bhushan Mahajan, Sushil Chopde, Sunil Yadav, 2018)

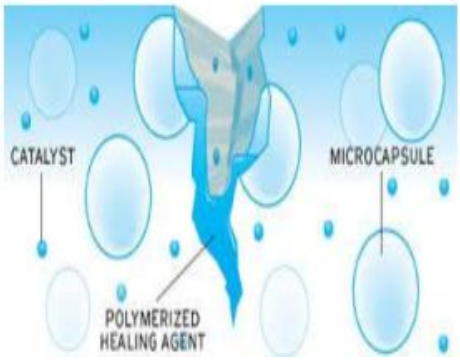


Fig. 13: Self-healing material, (Bhushan Mahajan, Sushil Chopde, Sunil Yadav, 2018)

H. Susmita Kamila

The focus of this study to introduce of the smart materials, classification and various application. Smart materials are also being described the present environment.

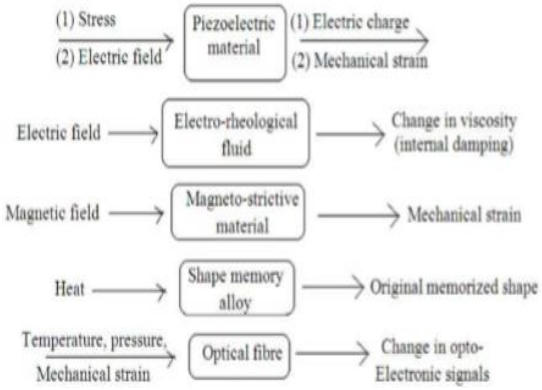


Fig. 14: Common smart material, (Susmita Kamila, 2013)

I. Priyanka Dixit et.al

In this paper smart material are that material remember configuration and can conform to them. This smart material can respond to changes there in electricity, heat and magnetic waves. Smart material used in smart building, environmental control, security and structural health monitoring for example strain measurement in bridges using embedded fiber optic sensors. MR fluid has been used to damp cable – stayed bridges and reduce the effects of earthquake with the advanced technology. The application of smart material likes –

1) Structural health monitoring
2) self – repair
3) structural engineering

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J. Swati Apurva, Satish Tailor, Neera rastogi

In this research study smart material application used in modern structures toward develop and plan smart city. The smart infrastructures support to the nation's economic and their social development with sustainable environment. Smart materials which can recover the generation of cracks by automatically producing compressive stress around them. Smart material having a self-repairing capabilities which recover the damages.

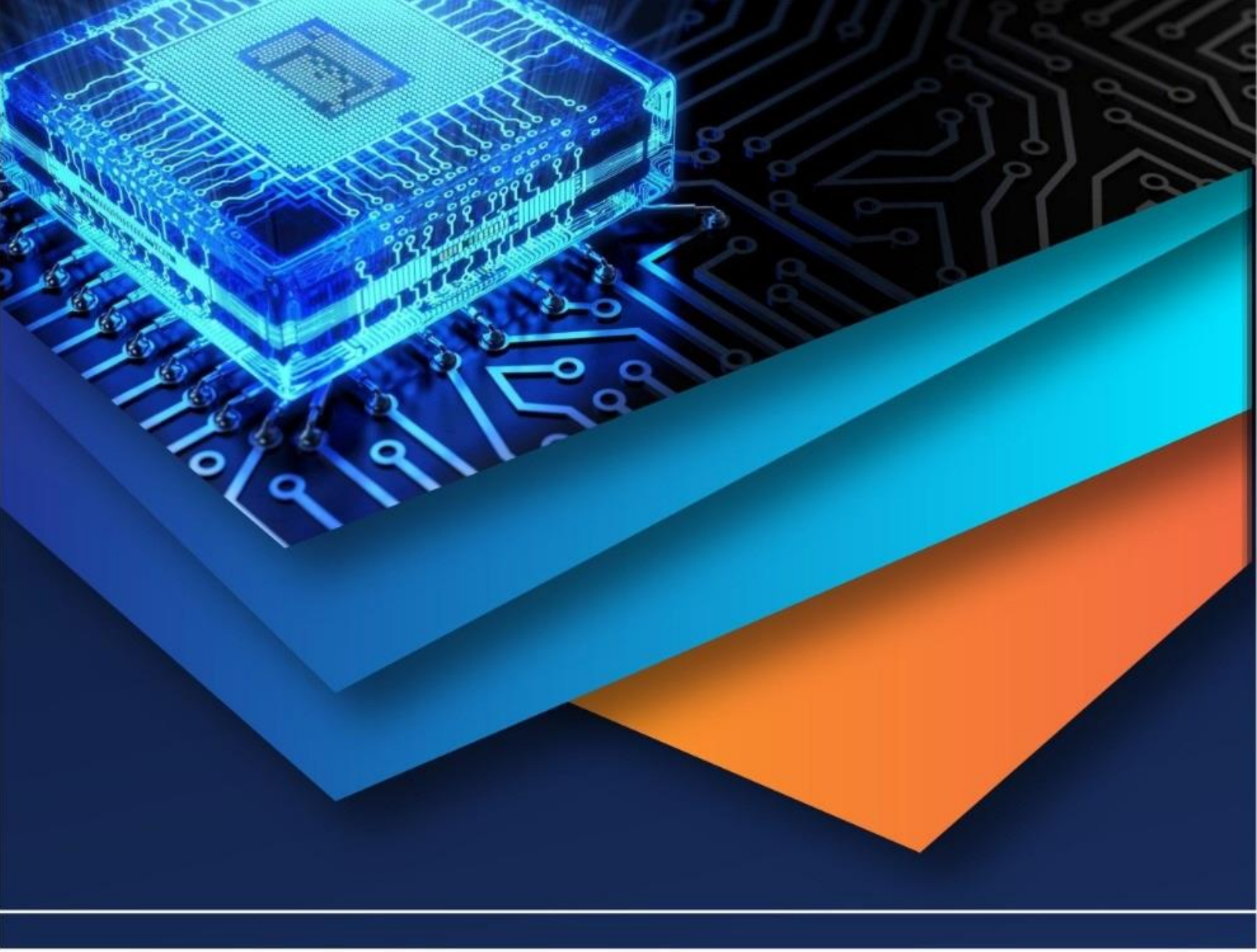
II. CONCLUSION

Attractive review result has been found when comparing all the views of different authors that smart materials used in the field of Civil Engineering, Biomedical Sciences, Nuclear sciences, Defence etc. that they have used a numerous number of smart materials and recommended the technologies related to their field

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