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Editorial

Smart Materials: Fabrication, Usage and Challenges

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Smart materials are the materials which can change their shape on application of force, temperature etc. They regain their structure when force is withdrawn. Such materials are finding their widespread usage in different industries as medical, semi-conductor, aerospace, defense etc. sectors.

These materials such as Nitinol, can act as per the stimulus applied and they are widely used in making artificial limbs etc.

Now a day's miniature medical instruments are also used which have a high degree of precision, accuracy. They are used in administering drugs, medicines etc. They are corrosion resistant and are compatible with the human body. They are also used in neurology, cardiology, orthopedics and stenting [1].

Nitinol are also widely used in MRI scans. As compared to stainless steels, the Nitinol are less susceptible to magnetic fields, hence are efficiently used in MRI scans.

They are also termed as shape memory alloys, as they can remember their shape and size at a particular temperature, pressure, force etc. Also SMA's are widely used in the humanoid robotic application. Piezoelectric smart materials and shape memory alloys are widely used in actuating instruments. Their advantages are lesser energy consumption, more adaptability to environment, and less polluting in nature.

The micro robots formed with help of smart materials help in drug delivery, and other minute surgeries which are otherwise not possible with normal equipment [2]. The fabrication and manufacturing of smart materials is done with help of 3D and 4D printing. The additive manufacturing helps in producing complex shapes and sizes. Even first 3 D modeling of object is done and then additive manufacturing is done to form the object [3].

Newer smart materials are also emerging as Graphene based smart materials [4]. The Graphene can be produced by chemical vapor deposition, Chemical modification both by oxidation and reduction. The Graphene materials are sensitive to a range of stimuli including gas molecules or bio molecules, electrical field, mechanical strain etc. They are also used in actuators, chemical or strain sensors, drug delivery etc.

Even the nano materials as Carbon Nanotubes are emerging as a novel materials of future. Researchers are fabricating nano composites from Carbon Nano tubes because of their lighter weight, high strength properties, high young modulus of elasticity etc. [6, 7]. The concept of sustainability is also very important as in coming time the coal deposits and mineral deposits will deplete and emphasis should be laid on the usage of smarter materials.

So the future of smart materials is very promising. Scientists and engineers are making different objects from smart materials. Even smart materials are used in construction of buildings [5]. The future belongs to lighter weight and stronger materials which can be used for making complex engineering structures and buildings. These materials have superb mechanical and strength properties which provide a rare mix of strength and lightweight.

The artificial intelligence and machine learning based modeling algorithms are being used in the synthesis of complex objects through additive manufacturing processes. The integration of artificial intelligence and machine learning technologies in the synthesis of Smart material based devices helped a lot in the automation of production.

Smart materials are future materials and are here to make a mark in different fields as bio mechanics, artificial limbs, robots, foundary, surgery, building and construction, mining, aerospace and defense technologies etc. In a way smart materials are a very prominent and emerging field of material science. There is a lot of scope in field of blending with plastics, nano-materials, bio degradable materials etc.

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