CHARACTERIZATION AND SYNTHESIS OF CARBON FIBER REINFORCED NANO COMPOSITE

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Abstract: Nanotechnology sometimes it is also called as nano tech is the changes which are done on the atomic, molecular and supra molecular level. Earlier the nano-technology. was explained as the technique which always focuses on the manipulation done on atomic and molecular level to fabricate some macro scale product, and now this is called as molecular nano-technology. A further more brief and generalized description is given by the National Nanotechnology Initiative, in which nano-technology is defined the same as the change of material which have at slightest one dimension of size 1 to 100 Nm. This description defines that quantum mechanics plays a very important role at this quantum-realm scale, this is the main reason for the shifting this from particular technology goal to a investigate group comprehensive of all the type of study and technology in which the unusual property of material plays an important role which occur below the given size of the threshold. This is just only because of that result which is therefore most obviously common to have a look on the advance form "nanotechnologies" and also “Nano scale technologies" which refer the broad range of the research whose main focus is on the size of atoms and molecules. Nano technology found a broad range of impending application which include manufacturing and martial, due to which government have also invest billions of dollars in the area of investigate where Nano-technology is involved. From side to side its nationwide Nanotechnology proposal, the investment of USA is 3.7 billion dollars. The investment of European Union 1.2 billion and the investment of Japan is 750 million dollars.

Key Words: Nano tubes, Reinforcement, Carbon fiber.

1. Introduction: The definition of Nano technology by size is naturally very broad, including fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, micro fabrication, etc. The research which is associated with Nano technology and applications related to this are having a very broad range, it is range as of extension of the conservative mechanism physics to a very different approach which is based on the self- assembly of the molecules, by developing the new material which have Nano scale dimensions and they will control the matter on the atomic level.

Scientists nowadays have a new topic to discuss which “future implication of Nano-technology”. It has both positive and negative impact. Nanotechnology no doubt is able to create much kind of different material and devices which will have a wide range of application, for e.g. in electronic, biomaterial, energy

production and medicine. On a different aspect, it has a reverse effect on the environment. Nanotechnology started many issues to discuss because they are related with the impact of Nano material on the environment and it is also concerned about the toxicity, and their overall effects on the global economics. These all concerns have started a debate among advocacy groups and the governments on whether there should be a special regulation of nanotechnology is warranted or not.

1.COMPOSITE MATERIAL

When two or more material are combined then the new material formed will be called as composite material. They may have different properties. When these two or more materials work together, they will give a new unique property. However, both the material does not dissolve or blend into each other therefore one can easily differentiate between the materials in the composite. In engineering composites materials include, Matrix is embedded in second phase in discontinuous form. This phase is mainly known as dispersed or reinforced phase this phase is normally have strong effect than the matrix, hence there is another name of this force known as reinforcement phase.

Many general materials like doped Ceramics, those are not considered as a composite such as metal alloys and Polymers have the very small number of additives is added dispersed phases in their structures, because their property are almost equivalent to individuals of their parent constituent for eg: the substantial property of steel are equivalent to those of unadulterated iron.

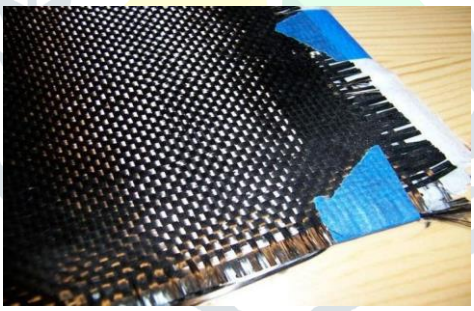

Fig. 1.1 Commercially available Carbon Fiber Sheet used as dispersed phase

required properties not present in any single generalized material. this method have a demerits that composites are costly than the base materials. Some common example which are made with the help of composite material are brake shoes, diesel piston and pads, the Beech craft aircraft and tires.

Strength of composites mostly depends on the quantity, array and type of fibre or strengthening. Generally it is seen that more amount of reinforcement more will be its strength. For certain conditions, glass fibres is added with other fibres, such as carbon or aramid to generate a amalgam compound that adds the characteristics for more than one reinforcing material. Moreover, mostly composites are created by adding fillers and additive which can totally alter its performance and processing characteristics. The complete anatomy of composite (Fig.1.2) is shown below.

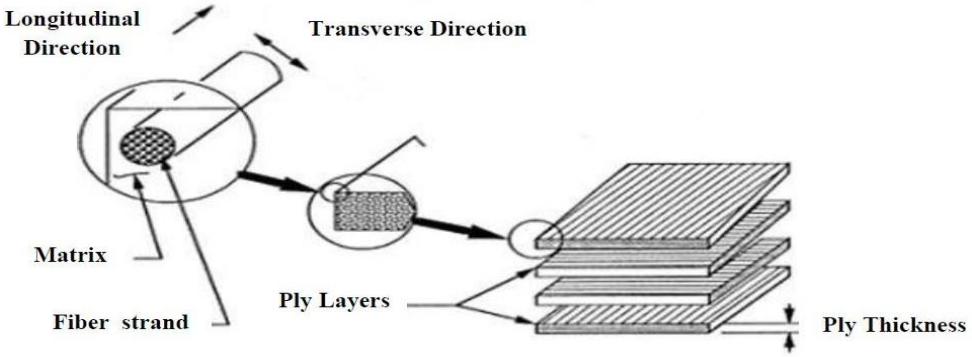

Fig. 1.2 Anatomy of Composite Material (Fibre Reinforced)

2. EXPECTED OUTCOME

Aggregates formation in the mixing of carbon nanotube in epoxy is improved to some extent because the treated carbon nanotube with cationic polymer get the positive charge. When these treated CNT is mixed in epoxy they experienced the repulsive force among themselves which will enhanced the dispersion of CNT in epoxy.

The process of applying the CNT over the carbon fiber increases the attractive force between the CNT, epoxy solution and carbon fiber which ultimately increases the strength of the composite

Increasing the strength to weight ratio which have many applications.

Hardness and flexural result will be improved.

2.1 MECHANICAL CHARACTERISTICS

A series of experiment is performed and after complete accomplishment of project mechanical test is performed and these result are quite astonishing that there is a great improvement in the mechanical characteristics a treated CNTs have a strong tensile strength among them but the bending result are not so impressive dispersion of CNTs are also improved

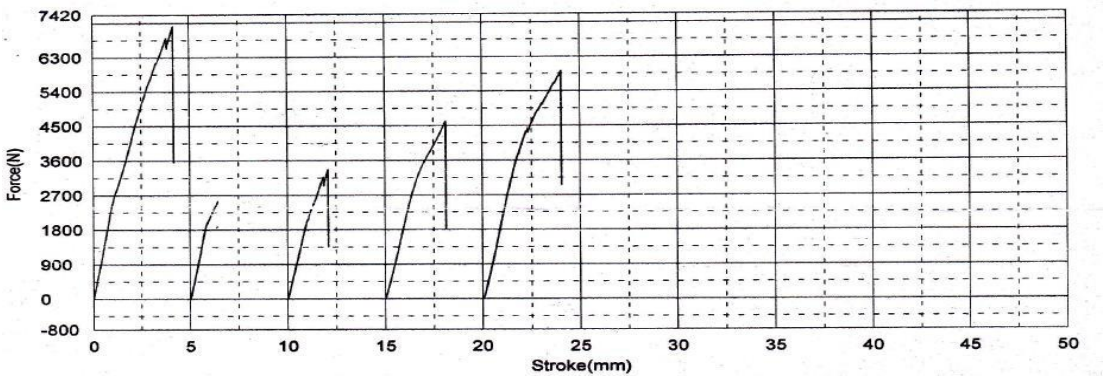

Figure 2.1 Graph showing the force versus stroke of different samples

Table 2.1 Result showing maximum stress and maximum strain

Name	Max_Force	Max_Disp	Max_Stress	Max_Strain
Units	**N**	**mm**	**N/mm2**	**%**
1	7120.63	4.18800	207.901	8.37600
2	2553.4	1.45200	92.8185	2.90400
3	3377.81	2.09700	101.497	4.19400
4	4622.34	3.12500	138.559	6.25000
5	5924.69	4.04200	200.837	8.08400
Mean	4719.78	2.98080	148.323	5.96160
Standard Deviation	1851.98	1.19610	54.0278	2.39220

Above table shows the outcome after testing samples. It can conclude from the above table maximum stress is ranging from 92 to 207 N/mm2 having an average value of 148 N/mm^2 this shows that result are quite impressive and corresponding maximum strain % value are 2.90400 to 8.37600 %.

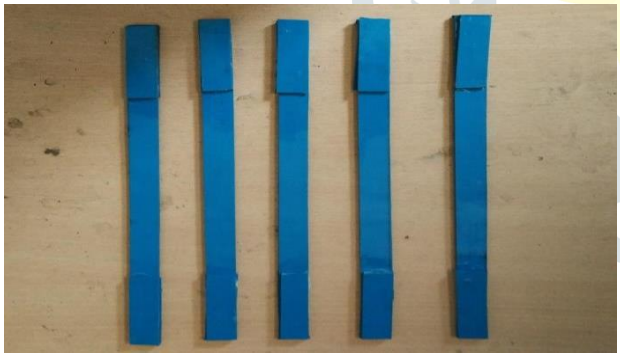

Figure 2.2 samples of 0.0%wt before test

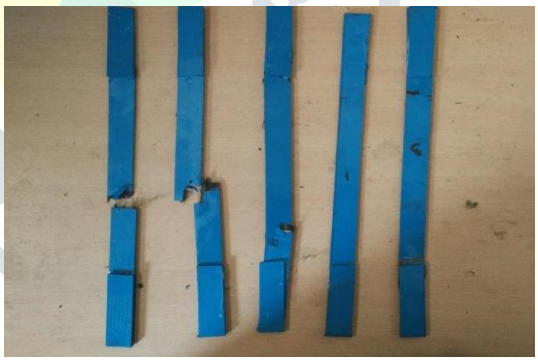

Figure 2.3 samples of 0.0%wt after test

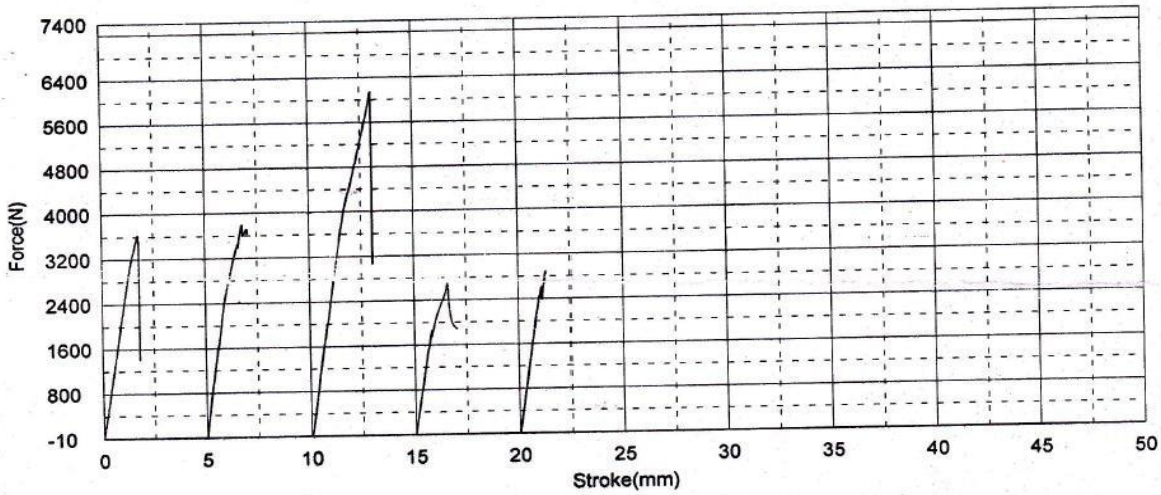

Figure 2.4 Graph showing tensile result of 0.2%wt CNTs

Table 2.2 Result outcome of 0.2% weight CNTs

Name	Max-Force	Max_Disp	Max_Stress	Max_Strain
Units	**N**	**mm**	**mm**	**%**
1	3632.81	1.76400	147.699	3.52800
2	3789.84	1.80300	127.176	3.60600
3	6149.69	3.03400	267.331	6.06800
4	2703.75	1.60100	126.937	3.20200
5	2890.00	1.33600	92.9858	2.67200
Mean	3833.22	1.90760	152.426	3.81520
Standard Deviation	1375.99	0.65595	67.1675	1.31190

Figure 2.5 samples of 0.2%wt before test

Figure 2.6 samples of 0.2%wt after test

Conclusion: Carbon fiber reinforced composite has been formed by using carbon fiber as reinforcement and epoxy mixed with CNTs as a matrix. CNTs are mixed into epoxy in different weight percentage (0.0 wt%, 0.2 wt%). For the processing of composite sheet shear mixing by homogenizer and then sonication is done. Better result can be seen when the percentage of CNTs are increased and among all the samples treated CNTs have the highest bending and tensile strength. Tensile and bending test has been performed as per the ASTM standard. The result outcome shows that 0.2%wt CNT have the highest stress value among the untreated samples which can be taken further to

demonstrate by increasing percentage of CNTs to optimal limit

REFERENCES

1. Drexler, K. Eric (1986). Engines of Creation: The Coming Era of Nanotechnology. Doubleday. ISBN 0-385-19973-2.
2. Drexler, K. Eric (1992). Nano systems: Molecular Machinery, Manufacturing, and Computation . New York: John Wiley & Sons. ISBN 0-471-57547-X.
3. Apply nanotech to up industrial, agri output, The Daily Star (Bangladesh), 17 April 2012.
4. Saini, Rajiv; Saini, Santosh, Sharma, Sugandha (2010). "Nanotechnology: The Future Medicine".
5. Cristina Buzea, Ivan Pacheco, and Kevin Robbie (2007). "Nanomaterials and Nanoparticles: Sources and Toxicity". Biointerphases 2 (4): MR17– 71.doi:10.1116/1.2815690. PMID 20419892.
6. Wang, X.; Li, Qunqing; Xie, Jing; Jin, Zhong; Wang, Jinyong; Li, Yan; Jiang, Kaili; Fan, Shoushan (2009). "Fabrication of Ultralong and Electrically Uniform Single-Walled Carbon Nanotubes on Clean Substrates". Nano Letters **9** (9): 3137– 3141.Bibcode:2009NanoL 9.3137W. doi:10.1021/nl901260b. PMID 19650638.