

A Review on Different Types of Manufacturing Methods of Carbon Fibres

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Abstract:

Carbon fibres are used due to their stiffness and light weight. Carbon fibers are made of anisotropic carbon^[1]. Carbon fibres are very promising in the field of research. Carbon fibres can be manufactured with different types of processes. Carbon fibres are versatile it has the ability to mix with different types of materials like plastics, metals, wood etc. with different types of manufacturing process. This paper deals with the reviewing of work in the manufacturing of carbon fibres.

Keywords: Carbon fibres, Carbon Nano Tubes, Manufacturing Methods, Polyacrylonitrile (PAN), Pitch ,applications,

1.Introduction.

Several methods have been developed for the production of the carbon fibres. basically carbon fibres are used in the manufacturing of the carbon nanotubes (CNTs) these are a type of polymer composites that are used in a numbers of applications. These tubes consist of rolled up hexagons, 10,000 times thinner than a human hair^[3]. Carbon fibres can be made from lignin with mixing it with the acrylonitrile this is very cheap and viable method for the production of carbon fibres. PAN being the predominant material in the processing of the carbon fibres can be mixed with lignin. Another method of making carbon fibres is the production of carbon fibre with the help of Hipco process by the use of carbon monoxide.



Figure 1: Carbon Fibres



Figure 2: Carbon Nano Tubes

2. LITERATURE REVIEW

Carbon nanotubes (CNTs) are the strongest materials among the nano particles and are most widely used because of their strong interfacial interactions and excellent stress transfer properties. Several research work is going on this new technology. Some of the methods for production of carbon fibres are vapour grown carbon fibres, Carbon tubes manufactured by the HIPCO process^[4], Carbon fibres manufactured from Lignin, Dispersion and functionalization techniques^[5], Carbon fibres can be also manufactured by polypropylene by using conventional melt spinning etc^[6]. The techniques of production have also come a long way but still have some room to be more efficient and cost effective. carbon fibres have amazing electronic and mechanical properties which lead to incredible forms of strength, and conductivity. Due to these qualities the field of applications is almost endless. From reinforcements in composites, sensors and probes, energy storage, electrochemical devices and

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nanometre sized electronics carbon fibres could revolutionize the world. Some of the prominent Research work has been detailed below for quick Reference as shown in table 1.

Table 1
Summary of Literature Review

S.No	Author Name	Year	Title	Conclusion/Benefits
1.	M. Endo, Y.A. Kim, T. Hayashi, K. Nishimura, T.Matusita, K.Miyashita,M. S. Dresselhau	2000	Vapor-grown carbon fibers (VGCFs) Basic properties and their battery applications.	Carbon Fibre manufactured by this methods can be ued in making electrochemical batteries in future times with long life.
2.	Michael J. Bronikowski,P eter A. Willis, Daniel T. Colbert, K. A. Smith, and Richard E. Smalley	2001	Gas-phase production of carbon single-walled nanotubes from carbon monoxide via the HiPco process: A parametric study	Single walled nano carbon fibres can be made by the use of high pressure CO over $\text{Fe}(\text{co})_5$. High production rates of carbon fibres can be achieved by CO pressure and catalytic reaction
3.	D A. Papargyri, Richard Day, A Nesbitt, D Bakavos	2008	Comparison of the mechanical and physical properties of a carbon fibre epoxy composite manufactured by resin transfer moulding using conventional and microwave heating	In this paper, microwave heating was incorporated into the resin transfer moulding technique comparison shows 50% reduction in cure cycle than conventional methods.
4.	S Bal and S.S Samal	2005	Carbon nanotube reinforced polymer composites–A state of the art	Carbon fibres can be easily combined with polymers and mixes homogeneously with the polymer matrix.
5.	Erik Frank, Frank,Hermanu tz,Michael R.Buchmeisr	2012	Carbon Fibers: Precursors, Manufacturing, and Properties	Carbon fibres are produced using PAN widely several other material available are lignin and Pitch are used as a precursors for carbon fibre production.

6.	E. Hammel,X. Tang,M. Trampert,T. Schmitt, K. Mauthner, A. Eder, P. Potschke	2004	Carbon nanofibers for composite applications	Carbon nanofibers and nanotubes are promising to revolutionise several fields in material science and are suggested to open the way into nanotechnology
7.	Peng-Cheng Ma,Naveed A. Siddiqui, Gad Marom, Jang-Kyo Kim	2010	Dispersion and functionalization of carbon nanotubes for polymer-based nanocomposites: A review ^[7]	Dispersion and functionalization techniques are used for the mixing of carbon fibres well with the polymer matrix so that to manufacture strong Carbon Reinforced polymer
8.	PrashanthS,Sub bayaKM,Nithin K,Sachhidananda S	2017	Fiber Reinforced Composites - A Review ^[8]	Paper gives a complete comparison between different types of Synthetic fibres with the carbon present
9.	Satish Kumar, Harit Doshi, Mohan Srinivasarao, Jung O. Park, David A.Schiraldi	2001	Fibres from polypropylene/nano carbon fibres composite ^[9]	Carbon fibres can be also manufactured by polypropylene by using conventional melt spinning equipment and possess superior strength
10.	Saleel Visal, Swapnil U. Deokar	2016	A Review Paper on Properties of Carbon Fiber Reinforced Polymers	NDT testing the early stage of heating phase is suitable for carbon fiber mapping and that both latter heating phase and cooling phase can be used for impact characterization
11.	Alejandro J. Rodriguez, Mauricio E. Guzman,	2010	Mechanical properties of carbon nanofiber/fiber-reinforced hierarchical polymer composites manufactured with multiscale-reinforcement fabrics	Hierarchical polymer composites containing carbon fiber layers showed an increase in interlaminar shear strength (ILSS) and

	Chee-Sern Lim, Bob Minaie			compressive strength
12.	Soraia Pimenta, Silvestre T.pinho	2010	Recycling carbon fibre reinforced polymers for structural applications: technology review and market outlook	A critical comparison between recycling processes proved each of them to have specific advantages and drawbacks
13.	R. Andrews, D. Jacques, A. M. Rao, T. Rantell, and F. Derbyshire	1999	Nanotube composite carbon fibers	Single walled carbon nanotubes can be manufactured by dispersing in isotropic petroleum pitch matrices with enhanced mechanical and electrical properties.
14.	Melissa Paradise , TarunGoswami	2006	Carbon nanotubes – Production and industrial applications	Carbon fibres have amazing electronic and mechanical properties which lead to incredible forms of strength, and conductivity
15.	Masaki Hojo ¹ , Yasuo Hirose ² , Takayuki Kusaka ³ and Masaaki Nishikawa ¹	2011	Recent Advances in Carbon Fiber Reinforced Plastics	New methods have been introduced in recent times to improve the strength and properties of CFRPs
16.	Zdenko Spitalsky ^a , Dimitrios Tasis ^b , Konstantinos Papagelis ^b , Costas Galiotis	2009	Carbon nanotube–polymer composites: Chemistry, processing, mechanical and electrical properties	Mechanical characteristics like tensile strength at break, elastic modulus and toughness of the composite materials

3. Conclusion:

After successfully reviewing the different type of manufacturing processes for carbon fibres we have find out that some processes are complex for production of carbon fibres and some are costly but from proper selection of process we can produce good quality of fibres. The HIPco process but after making comparison it was found out that these systems are too expensive or the processsing method is more complex than the PAN process. In conclusion it has been find out that carbon fibres when used with polymers are best suited for application and are cost effective.

4. Future Scope:

The potential of carbon fiber is almost limitless. Investigations shows that the work on the carbon fibres can be extended to a great level. carbon fibres can be mixed with different type of laminates to produce good strength materials with less weight.

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