

Assignment title: Technical Report Writing Module code: ACHA4005 Module title: Academic Skills Deadline: 29/11/2022	Student number: 2201130 Name: Shaun Elias University: University of Wales Saint David Trinity Course: Motorsport Engineering
---	---

Assignment research title: Use of Carbon fibre in motorsport

Contents Page

1. Title – page 1
2. Contents – page 2
3. Introduction – page 3
4. Literature Review – page 3&4
5. Discussion – page 3&4
6. Conclusion – page 4
7. reference List – page 5

Use of carbon fibre in motorsport

Introduction

The aim of this research study is to investigate into the use of carbon fibres in motorsport by first describing what carbon fibres are, the properties, the advantages and disadvantages, the current use of the material, and its importance in motorsport. The investigation uses research from academic resources as well as other resources including relevant related websites/articles which analyse the use of carbon fibres in motorsport engineering, specifically formula one cars. Carbon fibres have their advantages for motorsport (lightweight, strong) however, it has disadvantages as well (electrical conductor, expensive) therefore, this investigation will further look into how this can affect the use of the material in motorsport vehicles (Meredith et al., 2015).

Literature Review and Discussion

Carbon fibre is multiple fibres consisting of carbon atoms, this combined is a polymer composite. The properties of carbon fibres include strength, durability, lightweight, electrical conductor, and heat insulators. Therefore, it is commonly used in engineering and motorsports (Bhatt & Goe, 2017). This is because for motorsport vehicles like formula 1 cars it is necessary to have a lightweight car to be faster. It should be strong and durable so that when driving at great speeds with heavy equipment inside like the engine the car will not fall apart. A problem that arises with the use of carbon fibres is that it is a conductor of electricity which is not what you want with motorsport vehicles as it can cause corrosion (Fanni & Jweda, 2016). The most used carbon fibre polymer is polyacrylonitrile (PAN) and the other one used is pitch carbon fibres but that is not the most common one, these two differ as they require different conditions for the process. The PAN manufacturing process for the carbon fibre is mechanical and chemical, these procedures are complex, and the equipment needed is expensive. It involves spinning, stabilising the material (oxidisation), carbonisation (removing other elements through heating at high temperatures), and surface treatment (Goodhew et al., 1975; Bhatt & Goe, 2017; Huang, 2009).

In motorsport in the formula one, the McLaren team was the first to use carbon fibre polymer in their car as it provided better flexibility for the car design. The carbon fibre was first included in the car design in the monocoque as this is the structure of the body of the car and so is needed to be stiff which is a property of carbon fibre (Gilchrist & Curley, 1999; Case Study: Carbon Fibre, 2016). Since the first use of carbon fibre, it is used in a more variety of components in formula one teams such as the helmets, seats, and the steering wheel. To keep the driver safe and more comfortable as they are sat in seat for a long period of time, carbon fibre is used as it is a strong material that is moulded to fit the driver to protect them in any incidents and provide comfort (Carbon Fibre – F1technical.Net, 2002). The drivers steering wheel, this is so that it is light weight but is also has all the buttons and components that each individual driver requires without being too heavy (Scarborough, 2019). Carbon fibre in these elements is useful and beneficial as not only is it lightweight in the helmets and it is more durable, and it increases the driver's comfort.

Carbon fibre helmets can absorb forces of impact which gives more protection to the driver as the force from a crash is taken up by the helmet and not the driver. McLaren have made the seats in the formula one cars out of the carbon fibre material which is supposed to improve the driver's seat quality as it is built around the driver's body for comfort. There are other formula one teams that have also tried carbon fibre seats and this improves the driver's safety such as if there were a crash, they are easily accessible by lifting the seat and keeping them from any risk of injury (Carbon Fibre Composites Role in Formula 1 Racing, 3MB Co., 2015). Compared to before, the formula one manufacturers are now making many more areas of the car such as drive shafts and gearboxes out of the carbon fibre material. Nearly all the formula one car is being made with the carbon fibre material as it has the most beneficial properties to enhance performance (F1 Chassis, Behind the Scenes – YouTube, 2016). This is with it being lightweight that is the most helpful as it improves the speed of the car the lighter it is.

The future of carbon fibre in motorsport is promising as there is always developments needed to improve on the formula one racing cars. Recycling in Carbon fibre is one of the most looked at now as many formula one teams that are currently using carbon fibre are looking into recycling these materials as there are negative affects associated with using the carbon fibre material. For example, it has many carbon dioxide emissions as it is being produced (Pimenta & Pinho, 2012). Daniel Ricardo, from the McLaren formula one team, is looking at the natural fibre for the seats to reduce the carbon dioxide emissions into the atmosphere to reduce the negative impact of the environment. To do this, the McLaren team have suggested growing flax plants with solar energy which can be made into natural fibre. The McLaren team are now looking to use this for other areas of the car for the future as it reduces the carbon dioxide emissions as it is a more natural process (McLaren Racing – The next Step in McLaren's Use of Sustainable Composites in F1, 2021).

Conclusion

In conclusion, carbon fibre has many advantages for use in motorsport vehicles as the properties of the material are the same as what is required for formula one cars. Over the years carbon fibre has been used more in the development of formula one cars, starting from the monocoque to now majority of the car. It has disadvantages including the expense of the material and the emissions from the production, but they can be counteracted by recycling the material. There is a big future for natural fibres as stated by McLaren in the references above and this will be a more beneficial material as it will still improve driver performance with the necessary beneficial properties as well as having a more positive effect on the environment.

Reference List

- Bhatt, P., & Goe, A. (2017). Carbon Fibres: Production, Properties and Potential Use. *Material Science Research India*, 14(1), 52–57. <https://doi.org/10.13005/MSRI/140109>
- Carbon fibre - F1technical.net. (2002). Retrieved November 2022, from <https://www.f1technical.net/articles/3>
- Carbon Fibre Composites Role in Formula 1 Racing | 3MB Co., Ltd. (2015). Retrieved November 2022, from <http://www.3mb.asia/how-carbon-fiber-composites-play-a-significant-role-in-formula-one-racing/>
- Case study: Carbon Fibre. (2016). Retrieved November 2022, from <https://www.mclaren.com/group/case-studies/case-study-carbon-fibre/>
- F1 Chassis | Behind the scenes - YouTube. (2016). Retrieved November 2022, from https://www.youtube.com/watch?v=bhpx5kKSB_c&t=46s
- Fanni, S., & Jweda, F. (2016). *Design of carbon fibre composite driveshaft end fittings and adhesive joint for motorsport applications*. Retrieved November 2022, from www.kth.se
- Gilchrist, M. D., & Curley, L. (1999). Manufacturing and ultimate mechanical performance of carbon fibre-reinforced epoxy composite suspension push-rods for a Formula 1 racing car. *Fatigue and Fracture of Engineering Materials and Structures*, 22(1), 25–32. <https://doi.org/10.1046/J.1460-2695.1999.00133.X>
- Goodhew, P. J., Clarke, A. J., & Bailey, J. E. (1975). A review of the fabrication and properties of carbon fibres. *Materials Science and Engineering*, 17(1), 3–30. [https://doi.org/10.1016/0025-5416\(75\)90026-9](https://doi.org/10.1016/0025-5416(75)90026-9)
- Huang, X. (2009). Fabrication and Properties of Carbon Fibers. *Materials*, 2, 2369–2403. <https://doi.org/10.3390/ma2042369>
- McLaren Racing - The next step in McLaren's use of sustainable composites in F1. (2021). Retrieved November 2022, from <https://www.mclaren.com/racing/sustainability/sustainable-natural-fibre-composites/>
- Meredith, J., Bilson, E., Powe, R., Collings, E., & Kirwan, K. (2015). A performance versus cost analysis of prepreg carbon fibre epoxy energy absorption structures. *Composite Structures*, 124, 206–213. <https://doi.org/10.1016/J.COMPSTRUCT.2015.01.022>
- Pimenta, S., & Pinho, S. T. (2012). The effect of recycling on the mechanical response of carbon fibres and their composites. *Composite Structures*, 94(12), 3669–3684. <https://doi.org/10.1016/J.COMPSTRUCT.2012.05.024>
- Scarborough, C. (2019). *Multi-tasking made simple - understanding the modern Formula One steering wheel - Motorsport Technology*. <https://motorsport.tech/formula-1/understanding-the-f1-steering-wheel>