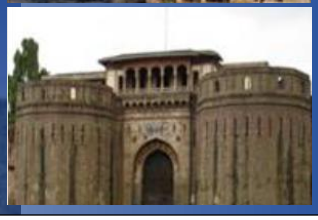
ASM INTERNATIONAL Pune Chapter

Chapter News Letter



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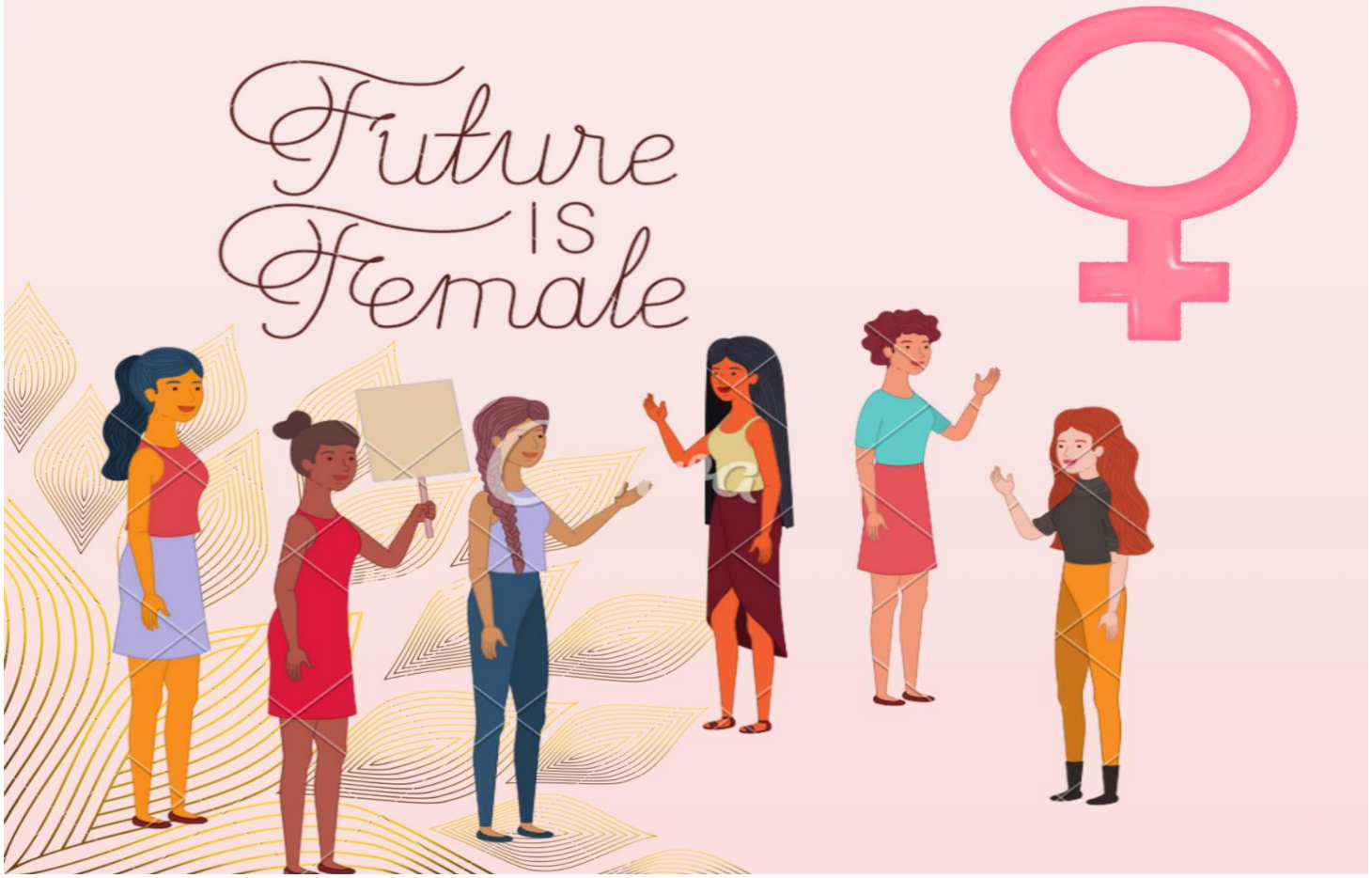
INTERNATIONAL WOMEN'S DAY



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EDITORIAL

Dear Readers,

Warm greetings on this special occasion of Women's Day! This year's theme, ***"Accelerate Action,"*** perfectly captures the relentless drive of women pushing boundaries, breaking stereotypes, and redefining possibilities across diverse fields—including the high-speed, high-stakes world of Formula 1 racing. Women in motorsports, like those in engineering, have overcome immense challenges with unwavering determination, paving the way for greater inclusivity, innovation, and excellence.

At the Material Advantage Chapter, CCOEW Nagpur, we take immense pride in nurturing young women mechanical engineers, equipping them with the knowledge, skills, and opportunities to excel in engineering. Our chapter serves as a platform for aspiring engineers to explore cutting-edge materials science, engage with industry experts, and contribute meaningfully to technological advancements. Through hands-on learning, mentorship, and collaborative initiatives, we empower them to take charge of their careers—at full throttle!

I extend my heartfelt congratulations to the **ASM Pune Chapter** for this special Women's Day edition of the newsletter. Your focus on ***"Women in F1 Racing"*** is truly inspiring, as it highlights the incredible talent, skill, and persistence of women making their mark in a high-performance, male-dominated industry. This recognition reinforces the message that with passion and perseverance, no track is too tough, no challenge too big.

As we celebrate the remarkable achievements of women in motorsport, engineering, and materials science, let us continue to accelerate action toward a more inclusive and dynamic future. May this Women's Day inspire us all to drive forward, break new ground, and redefine possibilities—on the racetrack, in laboratories, and beyond.

Wishing everyone a very Happy Women's Day!

May we all keep pushing boundaries and racing toward success!

Prof. Yogesh Dandekar

Faculty Advisor

MA Chapter

CCOEW, Nagpur

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#Accelerate Action

Yes, it is time to accelerate the action, in line with the theme of International Women's Day. We at Pune Chapter have been celebrating Women's Day since last four years. Our Women's Materials Engineers team lead by Ruta, Kruttika & Jaswandi are trying to make this better every year. The team has been innovative with the format of the celebration.

Pune Chapter initiated a unique Mentorship program exclusively designed with the help of experts from Tata Group. It caters both technical & business requirements. The focus is to groom Women Materials Engineers to take challenging positions in core technical, business management and entrepreneurship. Many industry leaders from both streams are willing to spare their time to guide and mentor students from our college. I request all readers to publicize this program & let all women metallurgists get its benefits.

The ASM International Pune Chapter is focussed on enhancing women participation in chapter activities and chapter management. We request all to encourage women materials engineers from your contacts to take ASM Pune Chapter Membership play an active role in it. In this sense, it's really time to

"ACCELERATE THE ACTION".

Udayan Pathak, FIE, FASM

Executive Director, Udayan Pathak & Associates

Immediate Past Chairman, ASM International, Pune Chapter

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WOMEN, WHEELS & WONDERS

Formula 1 (F1), long regarded as the pinnacle of motorsport, has historically been a male-dominated arena. However, women have been making remarkable strides, breaking barriers in engineering, strategy, and leadership roles. As we celebrate **International Women's Day 2024** with the theme **"Accelerate Action,"** it is essential to recognize and further **drive** women's participation in F1 and STEM fields.

➢ Women Shaping the Future of F1

While few women have had the opportunity to race in F1, many have played crucial roles behind the scenes, pushing the boundaries of technology and performance. Monisha Kaltenborn became the first female Team Principal, leading Sauber F1. Hannah Schmitz, Red Bull's Principal Strategy Engineer, has been pivotal in crafting race-winning strategies using advanced data analytics and AI-powered telemetry. Women like Bernadette Collins, an expert race strategist, have revolutionized team decision-making with computational models and predictive simulations.

In aerodynamics, materials science, and hybrid power units, women engineers and researchers have made significant STEM contributions, from optimizing wind tunnel testing to innovating sustainable fuel solutions. These achievements highlight that F1 is not just about driving—it's about engineering precision, cutting-edge innovation, and strategic excellence.

➢ Breaking Barriers: How Can We Accelerate Action?

While progress is visible, much remains to be done to increase female representation in F1. To truly "Accelerate Action," we need to:

- ✓ Encourage More Women in STEM & Motorsport

Universities, engineering institutions, and motorsport academies must actively promote scholarships and mentorship programs for young women aspiring to enter the field. Motorsport teams should invest in internships and

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apprenticeships specifically for women in mechanical, aerospace, and data sciences.

✓ Representation at All Levels

Increasing female presence in leadership, technical, and racing roles will create role models for the next generation. The FIA's Girls on Track initiative is a step forward, but F1 teams must take proactive measures in hiring and promoting women across departments.

✓ STEM Education & Awareness

Schools and colleges should integrate F1 tech in STEM curricula, making motorsport more accessible to young girls. Partnering with organizations like W Series and F1 Academy, which provide female racers with a platform, will inspire greater participation.

➢ **The Road Ahead: A More Inclusive**

F1 is evolving—from hybrid power units to AI-driven race strategies, and women are at the heart of this transformation. By accelerating action in STEM education, career opportunities, and visibility, we can ensure a more inclusive and diverse future for the sport.

This International Women's Day, let's commit to driving change, breaking stereotypes, and empowering women in motorsport. After all, F1 is not just about speed—it's about precision, innovation, and teamwork. And in that race, everyone deserves a fair start.

Let's accelerate action and fuel the future of women in F1!

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WOMEN IN THE FAST LANE

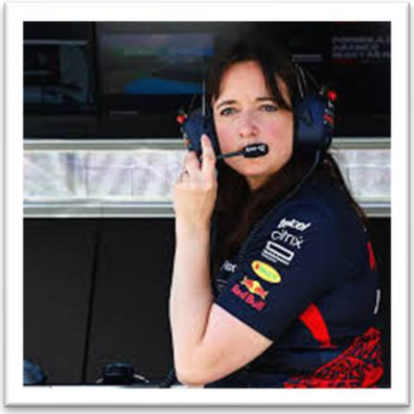
Maria Teresa de Filippis

Maria Teresa de Filippis was a true pioneer, breaking barriers as the first woman to race in Formula 1. In the late 1950s, she defied expectations in a male-dominated sport, entering five Grands Prix and even qualifying for one. Though her time in F1 was brief, her presence alone was a monumental achievement, paving the way for future generations of female drivers.

Monica Kaltenborn

Monica Kaltenborn made history as the first female team principal in Formula 1, leading the Sauber F1 Team from 2010 to 2017. In this high-pressure role, she oversaw the team's technical and strategic direction, making critical decisions that impacted their performance on the track. Kaltenborn's leadership in a top-tier racing team was a major step forward for women in motorsport.

Hannah Schmitz



Hannah Schmitz is a rising star in the world of Formula 1 strategy. As the Principal Strategy Engineer for Red Bull Racing, she plays a vital role in the team's success. Schmitz analyses vast amounts of data in real-time, making split-second decisions about pit stops, tire strategy, and race pace. Her expertise in data science and predictive modelling has been instrumental in Red Bull's championship wins.

Salva Marjan

Salva Marjan is an inspiring young driver from India, making her mark in the F1 Academy. As the first woman from Kerala to join this prestigious program, she's breaking new ground for Indian women in motorsport. Marjan's journey is a testament

to her talent and determination, and she serves as a role model for aspiring female racers in India and beyond.

Leena Gade

Leena Gade is a highly respected race engineer with a remarkable track record. She made history as the first female race engineer to win the 24 Hours of Le Mans, achieving these feat multiple times with Audi Sport. Gade's expertise in aerospace engineering and her deep understanding of race strategy have made her a sought-after figure in motorsport, working with top teams like Audi and Mahindra Racing.

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TECHNICAL ARTICLE

The Science of Speed: How Materials Drive F1 Innovation

Formula 1 (F1) has always been at the forefront of innovation, continuously pushing the boundaries of speed, efficiency, and safety. One of the key factors defining modern F1 performance is the use of advanced materials—particularly composites—which have transformed the engineering and design of race cars. These materials enhance durability, aerodynamic efficiency, safety, and sustainability.

The Rise of Composite Materials in F1

Traditionally, F1 cars were constructed using metals such as aluminium and steel, which, while strong, added significant weight. However, the introduction of carbon fibre composites revolutionized car design. These materials provide an exceptional strength-to-weight ratio, making cars lighter, faster, and safer.

1. Carbon Fiber Reinforced Polymers (CFRP)

Carbon fibre, woven into structures and bonded with epoxy resins, forms the backbone of modern F1 cars. Its lightweight nature improves acceleration and manoeuvrability, while its high impact resistance ensures driver safety. The monocoque chassis—a single, survival-cell structure—made of CFRP is now a mandatory safety feature in F1, capable of withstanding extreme crash forces.

2. Hybrid Composite Materials

To further enhance performance, F1 teams are incorporating hybrid composites that blend carbon fibre with other high-performance materials:

- Kevlar-Carbon Fiber Hybrids: Used in side pods and body panels to improve crash resistance while maintaining flexibility.

- Graphene-Infused Composites: Offer exceptional thermal conductivity and tensile strength, pushing the limits of durability.

Advancements in Aero Materials

Aerodynamics play a crucial role in F1 performance, and composite materials allow for the development of more efficient wing designs and flexible body structures:

- Flexible Carbon Composites: Used in wings, these materials dynamically adjust aerodynamics based on speed and load, ensuring optimal downforce.
- Nano-engineered Materials: The integration of carbon nanotubes improves stiffness and thermal stability, reducing material degradation.

Sustainability in F1: The Future of Green Composites

With an increasing focus on sustainability, F1 teams are exploring eco-friendly composite alternatives:

- Natural Fiber Composites: Materials such as flax- and hemp-based composites are being tested as sustainable, high-performance alternatives.
- Recyclable Carbon Fiber: Research into closed-loop recycling allows teams to reuse materials without compromising strength.

Conclusion

The evolution of materials in F1 demonstrates how cutting-edge engineering drives both performance and sustainability. As teams innovate with hybrid composites, flexible aerodynamics, and eco-friendly materials, the future of F1 looks faster, safer, and greener. These advancements highlight the incredible potential of materials science in shaping high-performance engineering, both on and off the track.

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Isha Nimkar

2nd Year

Mechanical Engineering

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DID YOU KNOW?

- **F1 Cars Generate Over 1.5 Million Data Points Per Second**

Every F1 car is equipped with 300+ sensors that send real-time data on engine performance, aerodynamics, tire wear, fuel efficiency, and braking force to engineers, who use AI and predictive analytics to refine race strategies.

- **Advanced Aerodynamics: The Key to Speed**

F1 cars rely on Computational Fluid Dynamics (CFD) simulations and wind tunnel testing to perfect their aerodynamics. Concepts like the "ground effect" (used in the 2022 regulations) create negative lift, increasing downforce and allowing cars to corner faster.

- **Carbon Fiber Chassis: Stronger Than Steel, Lighter Than Aluminum**

F1 was the first to introduce full carbon fiber monocoque chassis (McLaren MP4/1 in 1981). The material is five times stronger than steel and extremely lightweight, providing maximum safety and speed.

- **Hybrid Power Units: The Most Efficient Engines Ever Built**

F1 engines have a 50% thermal efficiency rate, making them among the most energy-efficient internal combustion engines in the world. The Energy Recovery System (ERS) captures waste heat and braking energy, converting it into additional horsepower.

- **Halo Device: A Titanium Life-Saver**

The Halo safety device, introduced in 2018, can withstand forces up to 12 tons (equivalent to a London bus). This innovation has saved multiple drivers' lives by protecting against cockpit impacts.

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TECHNICAL ARTICLE

The Intersection of Technology and Speed: 3D Printing and AI in Formula 1

One of the most significant advancements in recent years has been the combination of 3D printing and Artificial Intelligence (AI), two powerful technologies that have begun transforming the manufacturing processes used in F1 car production. F1 teams are constantly looking for ways to enhance their cars' performance through improvements in aerodynamics, weight distribution, and structural integrity.

The Evolution of F1 Manufacturing

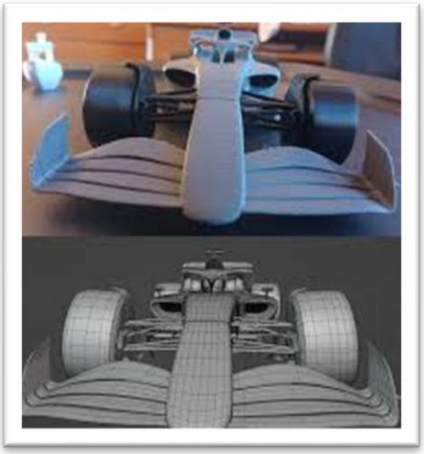
Traditional manufacturing processes have often been limited by time constraints, the need for complex designs, and material limitations. With the advent of 3D printing, however, F1 manufacturers can now produce more intricate and lightweight components that would have previously been impossible or impractical to create. 3D printing, also known as additive manufacturing, is the process of creating three-dimensional objects from a digital model by laying down successive layers of material.

In the context of F1, 3D printing has been used to create everything from engine components to structural parts and aerodynamic elements. For instance, components like intake manifolds, cooling ducts, and rearview mirrors have been 3D printed, with parts often designed specifically for performance optimization. The ability to print these parts using lightweight materials such as titanium or carbon fiber results in reduced weight without compromising strength or durability.

Artificial Intelligence's Role in 3D Printing

While 3D printing itself is revolutionary, the integration of AI into the design and production process elevates the capabilities of this technology. AI algorithms are used to optimize the design of components, ensuring that they meet the specific performance requirements of an F1

car. In the context of F1 racing, AI-driven optimization can improve aerodynamics, reduce drag, and enhance fuel efficiency, all of which contribute to faster lap times.

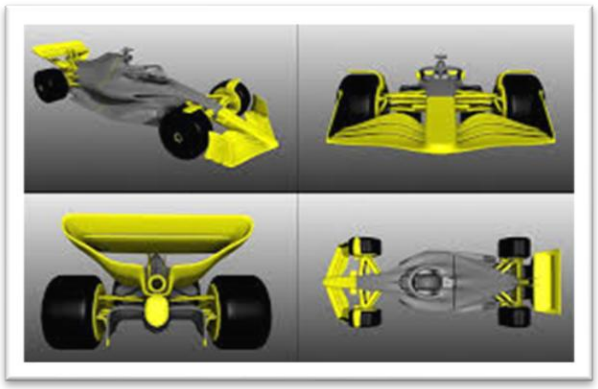


Moreover, AI can also help identify the most efficient use of materials, reducing waste during the 3D printing process. This is particularly important in F1, where every gram counts, and reducing weight is critical for performance.

One of the key benefits of combining AI with 3D printing is the ability to iterate and test designs quickly. Traditional manufacturing processes can take weeks or even months to produce a prototype, but with 3D printing, engineers can rapidly produce and test multiple iterations in a fraction of the time. AI plays a vital role here by providing real-time feedback on each iteration, ensuring that the final design is optimized for performance.

Women in F1: Contributing to the Technological Revolution

In recent years, the increasing representation of women in engineering, design, and manufacturing roles has been pivotal in driving advancements in 3D printing and AI in F1. At the forefront of this innovation is Mercedes-AMG Petronas Formula One Team, which has employed several women in critical engineering roles, particularly in aerodynamics and materials science. These women have contributed to the team's cutting-edge use of 3D printing technologies and have worked alongside AI specialists to develop lighter, more efficient components for their cars. Additionally, Dr. Claire Williams, Deputy Team Principal of the Williams F1 Team, is a strong advocate for diversity and has been an inspiration for many young women aspiring to work in F1. Her leadership has helped guide the team through some of the most challenging technological and competitive moments in the sport.



The Future of 3D Printing and AI in F1

Looking forward, the integration of 3D printing and AI in F1 manufacturing processes is poised to grow even more. As the technology continues to evolve, teams will be able to produce even more complex and optimized components. AI will become increasingly adept at predicting and simulating real-world conditions, providing designers with valuable insights

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into how parts will perform before they are even produced. Additionally, advancements in materials science will lead to new types of 3D-printable materials that are even lighter, stronger, and more durable, opening up new possibilities for F1 car design.

The next frontier for F1 teams is not just about improving performance on the track, but also making the manufacturing process more sustainable. As sustainability becomes an ever more pressing issue in the world of motorsport, reducing material waste and energy consumption will be key priorities. 3D printing, combined with AI-driven design optimization, offers a significant opportunity to achieve these goals by minimizing waste and energy use during production.

Conclusion

The marriage of 3D printing and AI has created a perfect storm of innovation in F1 manufacturing. Together, these technologies enable F1 teams to develop faster, lighter, and more durable cars while minimizing waste and improving sustainability. Women have played a crucial role in this technological revolution, with their contributions to engineering, design, and AI optimization helping to shape the future of the sport.

As the industry continues to evolve, the potential for 3D printing and AI in F1 will only grow, further pushing the limits of what is possible and ensuring that the sport remains at the cutting edge of technological advancements for years to come.

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QUIZ

➢ Unscramble:

- ✓ ECYEROV ENEGYR SMYETS
  Hint: This system captures and reuses lost energy in F1 cars.
- ✓ OCTCRLEIS NOLTOCR SYTEMS
  Hint: Manages power distribution in hybrid F1 cars.
- ✓ RLGAUODN YNEOTTHICLGO
  Hint: F1 teams use this to ensure they follow FIA regulations.
- ✓ CARBON IBRFES
  Hint: Strong, lightweight material used in F1 chassis.
- ✓ WIND NELTUN
  Hint: Used to test aerodynamics of an F1 car.

➢ In A Word:

- ✓ Which breakthrough F1 safety innovation, introduced in 2018, protects drivers from cockpit impacts?
- ✓ Which pioneering material was first introduced in F1 cars in the 1980s to improve safety and speed?
- ✓ Which component in the F1 power unit is responsible for converting kinetic energy into electricity?
- ✓ Who was the first female test driver in modern F1 history?
- ✓ Who was the first female team principal in F1?

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TECHNICAL ARTICLE

Engineering Precision: Innovations in Carbon Fiber Usage in Formula 1

Formula 1 (F1) has always been at the forefront of technological innovation, with carbon fibre playing a crucial role in car design due to its strength-to-weight ratio. This material is integral to F1's performance, offering lightweight yet strong components that contribute to speed and safety. Recent advancements, however, are pushing carbon fiber's role beyond performance, addressing sustainability and environmental concerns.

McLaren's Pioneering Use of Recycled Carbon Fiber (rCF)

McLaren is leading the charge in sustainability with their use of recycled carbon fibre (rCF). By repurposing carbon fiber waste materials, McLaren significantly reduces environmental impact. rCF offers a 90% reduction in lifecycle emissions compared to traditional carbon fiber, saving 27 tonnes of carbon emissions per tonne of rCF used. In 2022, if just 1% of global carbon fibre production were replaced with rCF, it would cut 32,535 tonnes of emissions—half of McLaren Racing's total emissions for that year. McLaren initially applied rCF to cockpit branding panels on their MCL60 cars, with plans to expand its use to more components as they aim for a fully circular F1 car by 2030.

Ferrari's Integration of Aerospace-Grade Carbon Fiber

Ferrari is also making strides with carbon fibre, particularly in their F80 hyper car. The F80's chassis uses T800 aerospace-grade carbon fibre, ensuring both exceptional structural integrity and minimal weight. This material contributes to the car's high-performance

features, including up to 1,000 kg of downforce at 155 mph. Ferrari's integration of this advanced carbon fibre highlights its versatility and strength, demonstrating its application in both high-performance and safety-critical components.

Implications for Advanced Materials and Manufacturing

The integration of recycled and aerospace-grade carbon fibers in F1 demonstrates a growing trend in the automotive industry toward sustainable and high-performance materials. By adopting recycled carbon fibre, F1 teams reduce material waste and emissions while maintaining performance. This shift opens new avenues for cost-effective production and environmental responsibility, benefiting both the automotive and aerospace industries.

Conclusion

F1's adoption of recycled and advanced carbon fibres highlights the sport's commitment to innovation and sustainability. Teams like McLaren and Ferrari are leading the way by demonstrating how these materials can enhance performance and reduce environmental impact. As these innovations shape the future of F1, they will likely influence industries worldwide, showcasing the potential of sustainable practices in high-performance manufacturing.

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