

# **MECHANICA** **ASSOCIATION**

# **MECH MAG**

## **2019-2020**



# PATRONS

Dr. M. Manickam,  
Chairman, MCET

Shri M. Hari Hara Sudhan,

Correspondent, MCET

Dr. C. Ramaswamy,  
Secretary, NIA Educational Institutions

# ADVISORY COMMITTEE

Dr. A. Rathinavelu,

Principal, MCET

Dr. I. Rajendran,  
Professor & Head, Mech. Engg

# CO-ORDINATORS

Dr. D. Nathan,  
Asso. Prof., Mech. Engg.

Mr. S. Gnanakumar,  
Asst. Prof., Mech. Engg.

**S SRIMATHI**  
18BME328

**EDITORS**

**R RANJITH KUMAR**  
18BME310



# VISION & MISSION

## VISION

To transform students from rural background into professional leaders of tomorrow in the field of Mechanical Engineering with a strong sense of social commitment.

## MISSION

To impart quality – engineering education leading to specialization in the emerging areas of CAD/CAM/CAE, Energy Engineering and Materials Technology to provide continually updated and intellectually stimulating environment to pursue research and consultancy activities.

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

**PEO1. Technical Expertise:** Actively apply technical and professional skills in engineering practices towards the progress of the organization or the entrepreneurial venture in competitive and dynamic environment.

**PEO2. Lifelong Learning:** Own their professional and personal development by continuous learning and apply the learning at work to create new knowledge.

**PEO3. Ethical Knowledge:** Conduct themselves in a responsible, professional and ethical manner supporting sustainable economic development which enhances the quality of life.

### PROGRAMME OUTCOMES (PO)

On successful completion of B.E. Mechanical Engineering programme, graduating students/graduates will be able to:

**PO1.** Apply knowledge of basic sciences and engineering concepts to solve complex mechanical engineering problems.

**PO2.** Identify, formulate, and analyze engineering problems using scientific principles and concepts.

**PO3.** Design products, manufacturing processes and facilities that deliver the requirements of the target customers and desired quality functions.

**PO4.** Conduct experiments, analyze and interpret data to

provide solutions for engineering problems.

**PO5.** Use appropriate tools and techniques to solve engineering problems.

**PO6.** Apply contextual knowledge to make informed decisions in societal, health, safety, legal, entrepreneurial and cultural issues.

**PO7.** Demonstrate the knowledge of need for sustainable development in providing engineering solutions in global, environmental and societal contexts.

**PO8.** Practice Ethical responsibility.

**PO9.** Work effectively in teams and build/manage interpersonal relationships.

**PO10.** Communicate effectively through oral, non-verbal and written means.

**PO11.** Apply management principles to manage individual and team work for executing projects in a multidisciplinary environment.

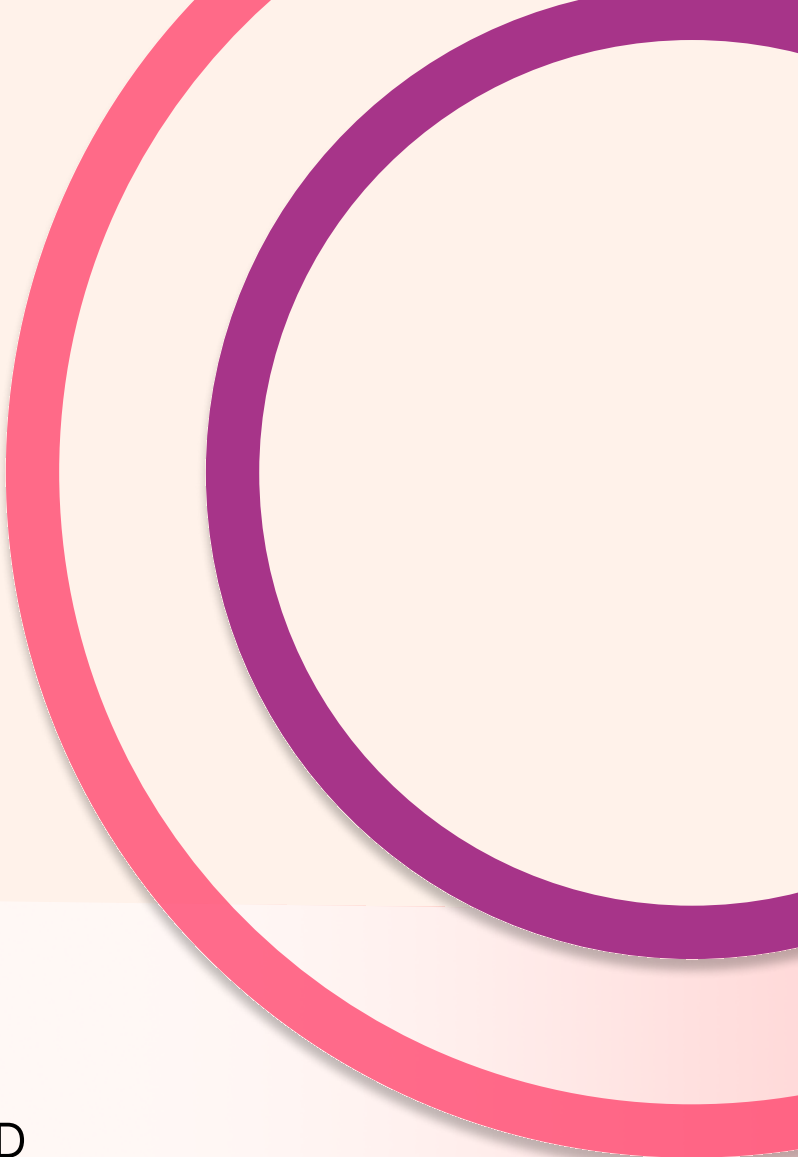
**PO12.** Articulate and engage in pursuit of career and life goals through continuous Learning.

### PROGRAMME SPECIFIC OUTCOMES (PSOS)

**PSO 1:** Demonstrate functional competencies for roles in design, manufacturing and service by learning through centers of excellence and industrial exposure.

**PSO 2:** Demonstrate behavioral competencies required for roles in design, manufacturing and service by learning through structured professional skills training.

# EXPO 2020

- 
- 01.**FORD  
Manufacturing Batteries
  - 02.**METALLIC WOOD
  - 03.**LAND ROVER  
Hydrogen electric defender
  - 04.**GENESIS GV 60
  - 05.**ADRENOX
  - 06.**PORCHE  
Electric vehicles

# 01

# FORD

## Manufacturing Batteries

**RAJ SHANGAMESHWARAN B**

**19BME088**

FORD AND SK INNOVATION ANNOUNCE THAT THEY WILL CREATE A JOINT VENTURE – TO BE CALLED BLUEOVALSK – TO PRODUCE BATTERY CELLS.

- BlueOvalSK to produce approximately 60 gigawatt hours (GWh) annually with potential to expand, starting mid-decade
- By 2030, Ford expects annual energy demand for its vehicles will be up to 140 GWh annually in North America and up to 240 GWh globally; the company has invested in and is working with a number of battery suppliers to secure capacity and scale delivery for next-generation Ford and Lincoln battery electric vehicles
- The BlueOvalSK MoU builds on Ford's recently announced investments to accelerate R&D of battery technology and manufacturing – including a new global battery center of excellence and an additional investment in a solid-state battery startup.

DEARBORN, Mich., May 20, 2021 –

Ford and SK Innovation announced today they have signed an MoU to create a joint venture – to be called BlueOvalSK – to produce

approximately 60 GWh annually in traction battery cells and array modules, starting mid-decade, with potential to expand.

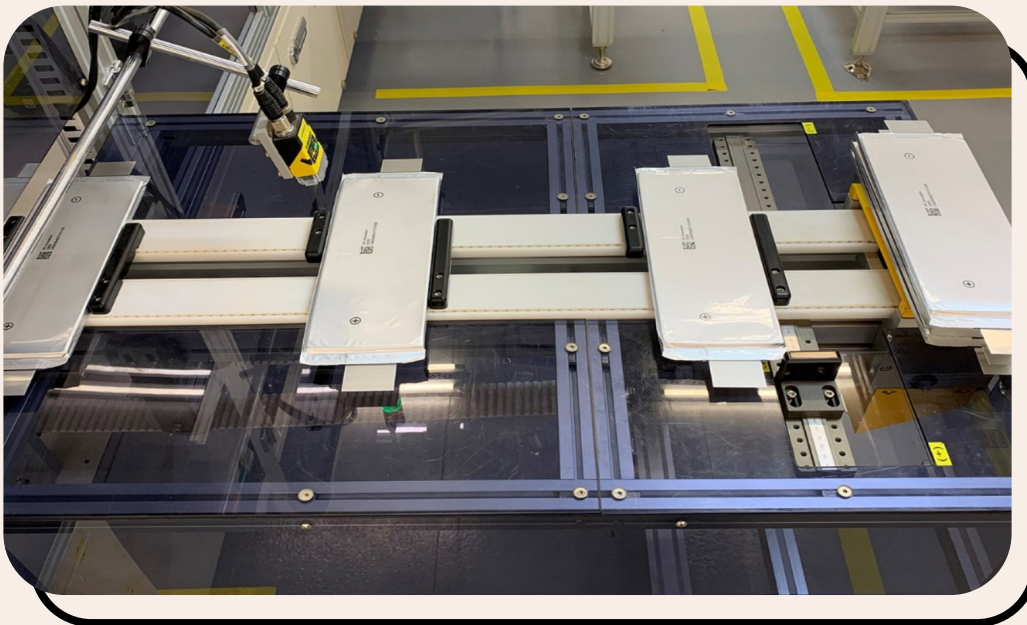
"This MoU is just the start; it's a key part of our plan to vertically integrate key capabilities that will differentiate Ford far into the future," said Jim Farley, Ford president and CEO. "We will not cede our future to anyone else."

"We are delighted to be entering into collaboration with Ford, America's leading and iconic automaker. Ford is one of the most active players in vehicle electrification today. We are proud to be opening this new chapter in their long history," said Kim Jun, SK Innovation CEO & President. "Our JV with Ford will play a pivotal role in fleshing out the electric vehicle value chain in the United States, a key objective of the current U.S. administration."

The creation of the JV is subject to definitive agreements, regulatory approvals and other conditions. Next-gen cells and arrays will be used to power several future Ford battery electric vehicles.

“Through the JV, Ford and SKI will jointly develop and industrialize battery cells at scale that are tailored to deliver optimum performance and value for our Ford and Lincoln customers,” said Lisa Drake, Ford’s North America chief operating officer. “SKI is an important partner in helping deliver batteries with better range and value for our fully electric vehicles by mid-decade.” Ford’s global BEV plan calls for at least 240 gigawatt hours (GWh) of battery cell capacity by 2030 – roughly 10 plants’ worth of capacity. Approximately 140 GWh will be required in North America, with the balance dedicated to other key regions, including Europe and China.

“Global automakers have praised SK Innovations’ EV batteries for their safety, high capacity and long life,” said Jee Dong-seob, Head of SK Innovation’s Battery Business. “SK Innovation will be supplying batteries for the fully electric version of Ford’s legendary and best-selling F-150 pickup truck. We are thrilled to be supporting the electrification of a vehicle that represents the very best of American automaking.” SK Innovation is a global energy conglomerate headquartered in Seoul, South Korea. The company has pioneered the development of mid- to large-size EV batteries since 1991 and has expanded its battery operations globally since 2010. SK already operates a battery plant



in Commerce, Georgia, USA – serving two global OEMs – and is expanding its production capacity in the European Union and China. SK Innovation plans to become one of the world’s top three EV battery suppliers by 2025 with over 125 GWh in global production capacity. SK Innovation has specialized in the development and commercialization of high-nickel NCM battery technology. The company developed the world’s first NCM-811 battery in 2016 and continued to innovate and to develop the world’s first Nickel 9 battery that will be mass produced in the U.S., powering Ford’s F-150 Lightning.

## FORD GAINING EV MOMENTUM

Ford plans to lead the electric vehicle revolution – including by delivering fifth-generation lithium ion batteries as well as preparing for the transition to solid-state batteries, which promise longer range, lower cost and safer EVs for customers.

Ford this year announced its commitment to invest at least \$22 billion through 2025 to deliver connected, all-electric vehicles, building on its areas of strength, starting with EV



To support its longer-term battery plans, Ford is investing in battery R&D. Last month, Ford announced a new global battery center of excellence – named Ford Ion Park – to accelerate its battery and battery cell technology R&D – including future battery manufacturing. Ford is building on nearly two decades of battery expertise by centralizing a cross-functional team of 150 experts in battery technology development, research, manufacturing, planning, purchasing, quality and finance to help Ford more quickly develop and manufacture battery cells and batteries, ultimately aiming to deliver more, even better, lower cost EVs for customers.

The Ford Ion Park team already is underway. In addition, a \$185 million collaborative learning lab in Southeast Michigan that is dedicated to developing, testing and building vehicle battery cells and cell arrays opens late next year. Earlier this month, Ford also announced it is growing its investment in Solid Power, an industry-leading producer of all-solid-state batteries for EVs. Initially investing in Solid Power in 2019, Ford is making an additional equity investment to help accelerate further development of solid-state vehicle battery technology, contributing to a \$130 million Series B investment round in which the BMW Group becomes an equal equity owner with Ford. Solid-state batteries are showing great promise. They don't use the liquid electrolyte found in conventional lithium-ion batteries, can be lighter, with greater energy density and provide more range and lower cost. They also can be made on today's lithium-ion battery lines, allowing Ford to reuse about 70 percent of its capital investment in lithium-ion manufacturing lines.

## PROVEN ELECTRIFICATION EXPERTISE

SK Innovation has a spotless health and safety record and has not registered a single EV battery-related fire.

Ford has been actively involved in battery research and electric vehicles, starting with Henry Ford and Thomas Edison. To date, the company has secured more than 2,500 U.S. patents in electrification technologies, with another 4,300 patents pending.

Since 2004, Ford has sold more than 1 million hybrids, plug-in hybrids and all-electric vehicles and integrated four generations of batteries into its vehicles. By year-end, the company will be manufacturing electrified vehicles and supporting technologies at more than 15 powertrain and vehicle assembly plants globally. Ford has assembled hybrid battery packs and electric motors in Michigan since 2012. That same year, Ford invested \$135 million to design, engineer and produce these components for hybrids. It included a combined 170 jobs at the Rawsonville plant to assemble batteries and VanDyke Transmission plant to assemble e-motors, plus hiring more than 50 electric vehicle engineers.

### About Ford Motor Company

Ford Motor Company (NYSE: F) is a global company based in Dearborn, Michigan. The company designs, manufactures, markets and services a full line of Ford trucks, utility vehicles, and cars – increasingly including electrified versions – and Lincoln luxury vehicles; provides financial services through Ford Motor Credit Company; and is pursuing leadership positions in electrification; mobility solutions, including self-driving services; and connected vehicle services. Ford employs approximately 186,000 people worldwide. For more information regarding Ford, its products and Ford Motor Credit Company, please visit [corporate.ford.com](https://corporate.ford.com).

# 02 METALLIC WOOD

JEFFIN P JAIMON

19BME002

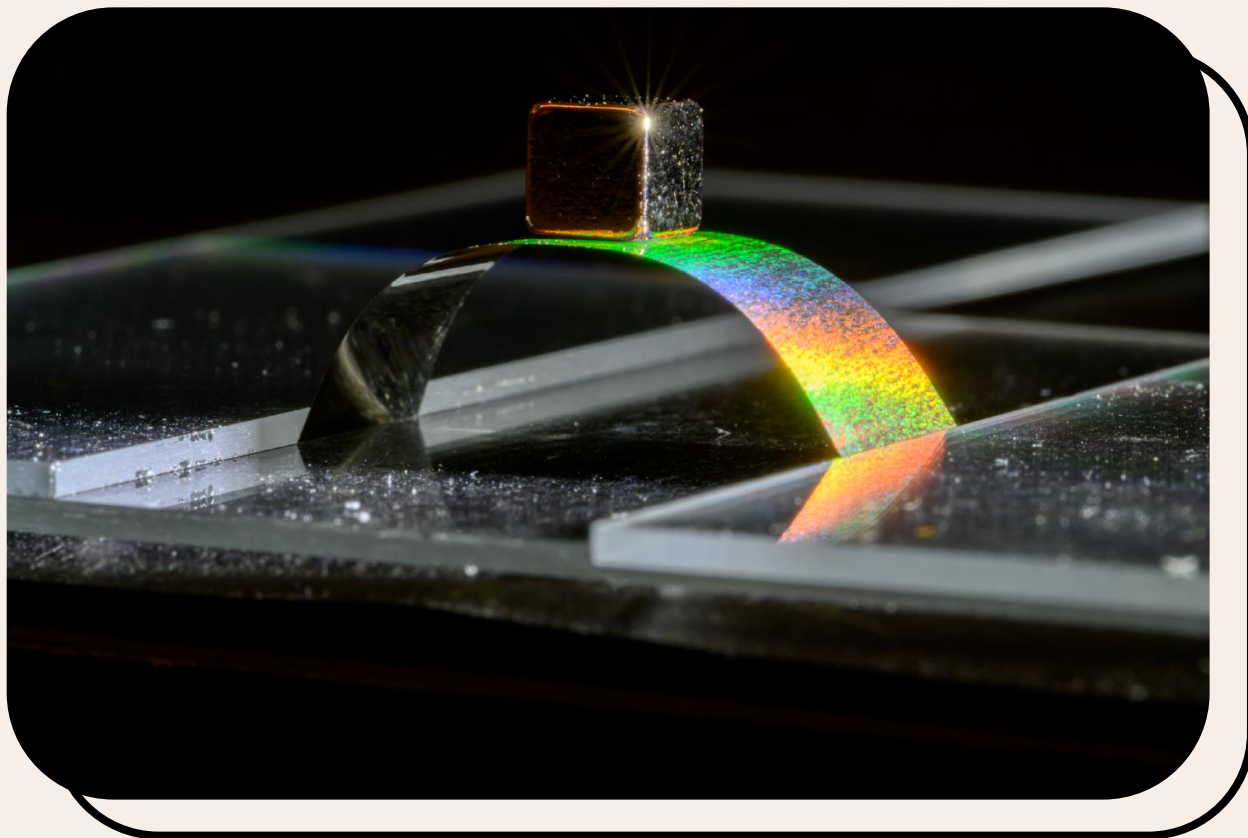
The precise spacing of these gaps not only gives metallic wood the strength of titanium at a fraction of the weight, but unique optical properties. Because the spaces between gaps are the same size as the wavelengths of visible light, the light reflecting off of metallic wood interferes to enhance specific colors. The enhanced color changes are based on the angle that light reflects off of the surface, giving it a dazzling appearance and the potential to be used as a sensor.

Penn Engineers have now solved a major problem preventing metallic wood from being manufactured at meaningful sizes: eliminating the inverted cracks that form as the material is grown from millions of nanoscale particles to metal films big enough to build with. Preventing these defects, which have plagued similar materials for decades, allows strips of metallic wood to be assembled in areas 20,000 times greater than they were before.

James Pikul, assistant professor in the Department of Mechanical Engineering and Applied Mechanics, and Zhimin Jiang, a graduate student in his lab, have published a study demonstrating this improvement in the journal *Nature Materials*.

When a crack forms within an everyday material, bonds between its atoms break, eventually cleaving the material apart. An inverted crack, by contrast, is an excess of atoms; in the case of metallic wood, inverted cracks consist of extra nickel that fills in the nanopores critical to its unique properties.

“Inverted cracks have been a problem since the first synthesis of similar materials in the late 1990s,” says Jiang. “Figuring out a simple way of eliminating them has been a long-standing hurdle in the field.”



These inverted cracks stem from the way that metallic wood is made. It starts as a template of nanoscale spheres, stacked on top of one another. When nickel is deposited through the template, it forms metallic wood's lattice structure around the spheres, which can then be dissolved away to leave its signature pores. However, if there are any places where the spheres' regular stacking pattern is disrupted, the nickel will fill those gaps, producing an inverted crack when the template is removed.

"The standard way to build these materials is to start with a nanoparticle solution and evaporate the water until the particles are dry and regularly stacked. The challenge is that the surface forces of water are so strong that they rip the particles apart and form cracks, just like cracks that form in drying sand," Pikul says. "These cracks are very difficult to prevent in the structures we are trying to build, so we developed a new strategy that allows us

to self-assemble the particles while keeping the template wet. This prevents the films from cracking, but because the particles are wet, we have to lock them in place using electrostatic forces so that we can fill them with metal."

With larger, more consistent strips of metallic wood now possible, the researchers are particularly interested in using these materials to build better devices.

"Our new manufacturing approach allows us to make porous metals that are three times stronger than previous porous metals at similar relative density and 1,000 times larger than other nanolattices," Pikul says. "We plan to use these materials to make a number of previously impossible devices, which we are already using as membranes to separate biomaterials in cancer diagnostics, protective coatings, and flexible sensors."

# 03 LAND ROVER

## Hydrogen Electric Defender

**SANKARA NARAYANAN D**

20BME343

Jaguar Land Rover will start testing a Land Rover Defender prototype powered by a hydrogen-electric powertrain in late 2021. The move is purely about developing and evaluating the technology and doesn't necessarily indicate that a hydrogen-fueled Jaguar or Land Rover is coming to showrooms anytime soon, though the automaker has hinted in the past that hydrogen has a role to play in its move to have a zero-emission option across its lineup by 2030, and only zero-emission vehicles in its lineup by 2036.

Jaguar Land Rover is developing a hydrogen-electric powertrain that relies on a fuel-cell to combine hydrogen and oxygen in a process that generates electricity and only leaves water as a byproduct. The generated electricity is used to power electric motors driving the wheels, as well as charge a relatively small battery that can also help power the electric motors during high-load situations.

Compared to simpler battery-electric cars, hydrogen-electric cars have minimal loss of range in extreme temperatures. They also have refueling times similar to gas and diesel cars, though actually finding a fuel station that supplies hydrogen is largely impossible in the United States (and most other countries) at present outside of a few spots in California and Hawaii.

The hydrogen-electric Defender prototype is part of the United Kingdom government-funded Project ZEUS (zero and low-emission vehicles in urban society) stimulus program for the automotive industry focused on green technology, which was first announced in mid-2020.

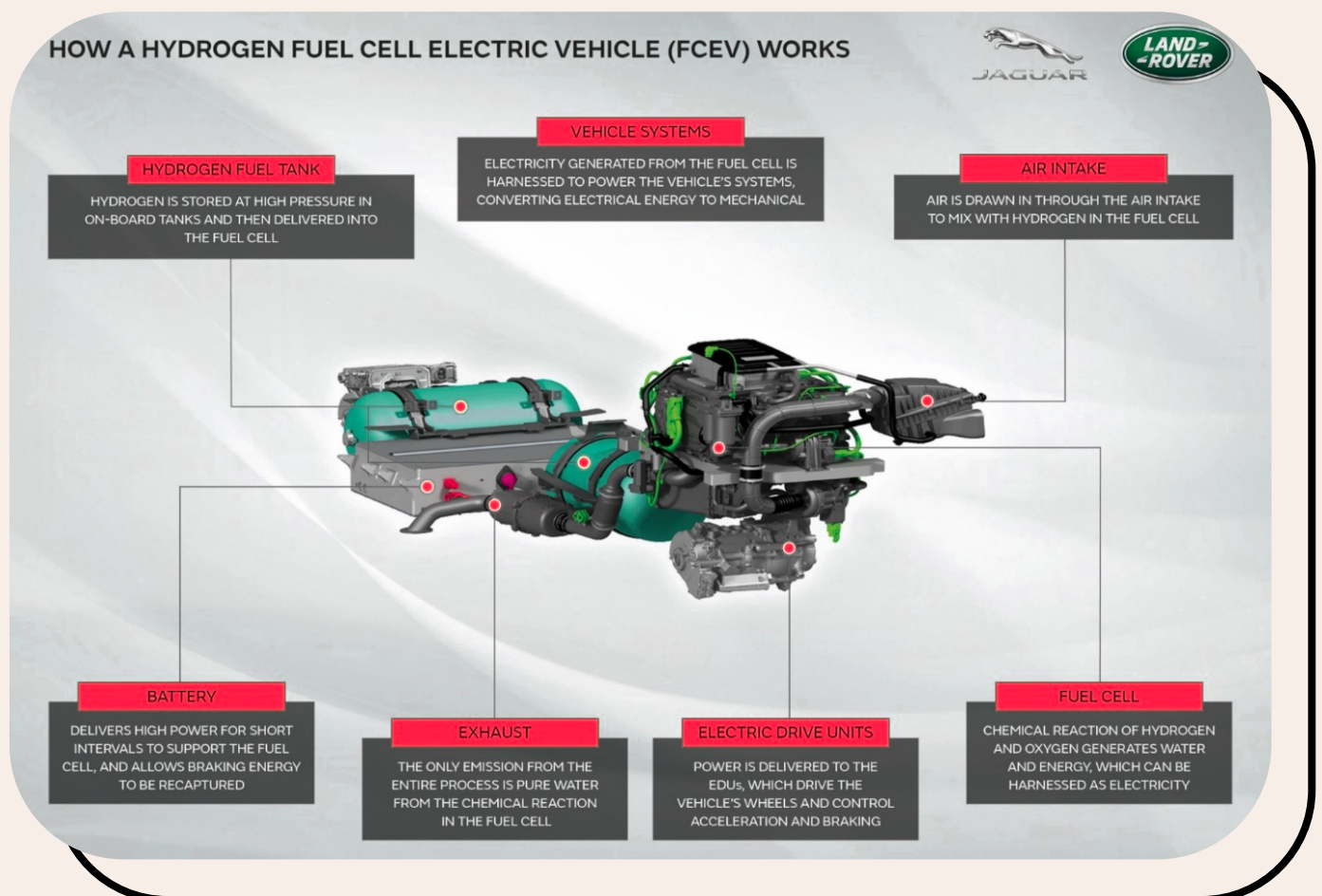
To date, Jaguar Land Rover has primarily focused on plug-in hybrid and battery-electric vehicles when it comes to alternative powertrains. The automaker is beginning to experiment with fuel cells at a time when some rivals are moving away from the technology.



Mercedes-Benz said last year that it would end fuel-cell development for passenger cars, shifting to commercial vehicle applications instead. BMW plans to launch a production version of the X5-based i Hydrogen Next concept in 2022, but it will be built in low volumes. BMW has said a mass-market hydrogen model wouldn't be ready until the second half of the decade at the earliest, and then only if market conditions were favorable.

Only Honda, Hyundai and Toyota currently sell hydrogen-electric cars in the U.S., though sales are limited due to the aforementioned lack of fueling infrastructure.

“The expert in anything was once a Beginner.”



# 04 GENESIS GV 60

SANTHOSH KUMAR S  
19BME057

## SPECIALITY : WIRELESS CHARGING

The Genesis GV60 is a battery-electric subcompact luxury crossover SUV produced by Korean luxury automaker Genesis, a luxury vehicle division of Hyundai. Slotted below the ICE-powered GV70, it is the first Genesis product to be developed on the Hyundai Electric Global Modular Platform (E-GMP)

## MANUFACTURER – GENESIS

Production - 2021 (to commence)  
Assembly - South Korea: Ulsan



## POWER TRAIN

Battery - 58–74.5 kWh  
Electric range - Up to 500 km (311 mi)  
Plug-in charging - 350 kW at 800

## BODY AND CHASSIS

Class - Subcompact luxury crossover SUV

Body style - 5-door coupé SUV

Layout - Rear-motor, rear-wheel drive, Dual-motor, all-wheel drive

Platform - Hyundai E-GMP

## GENESIS INDIA LAUNCH PLANS

We had reported back in 2019 that Genesis was looking to enter the Indian market, with the first model set to be an SUV. The brand currently has two SUVs on sale in global markets – the GV80 and the Hyundai Tucson-based GV70 – though it's not yet known which could be the first to arrive. There has been no official word from Hyundai since then on introducing the Genesis brand in India



It was revealed globally on 19 August 2021. Codenamed JW during development, the vehicle sits on a dedicated EV platform shared by the Hyundai Ioniq 5 and the Kia EV6. Powertrain details include a single-motor application for lower trim levels as well as a dual-motor all-wheel-drive model. In addition, the GV60 is the first to apply a new Genesis emblem imprinted with an elaborate Guilloche pattern and a clamshell hood that removes joints between the bodies

# 05 ADRENOX

PRATHESHWARAN H

19BME075

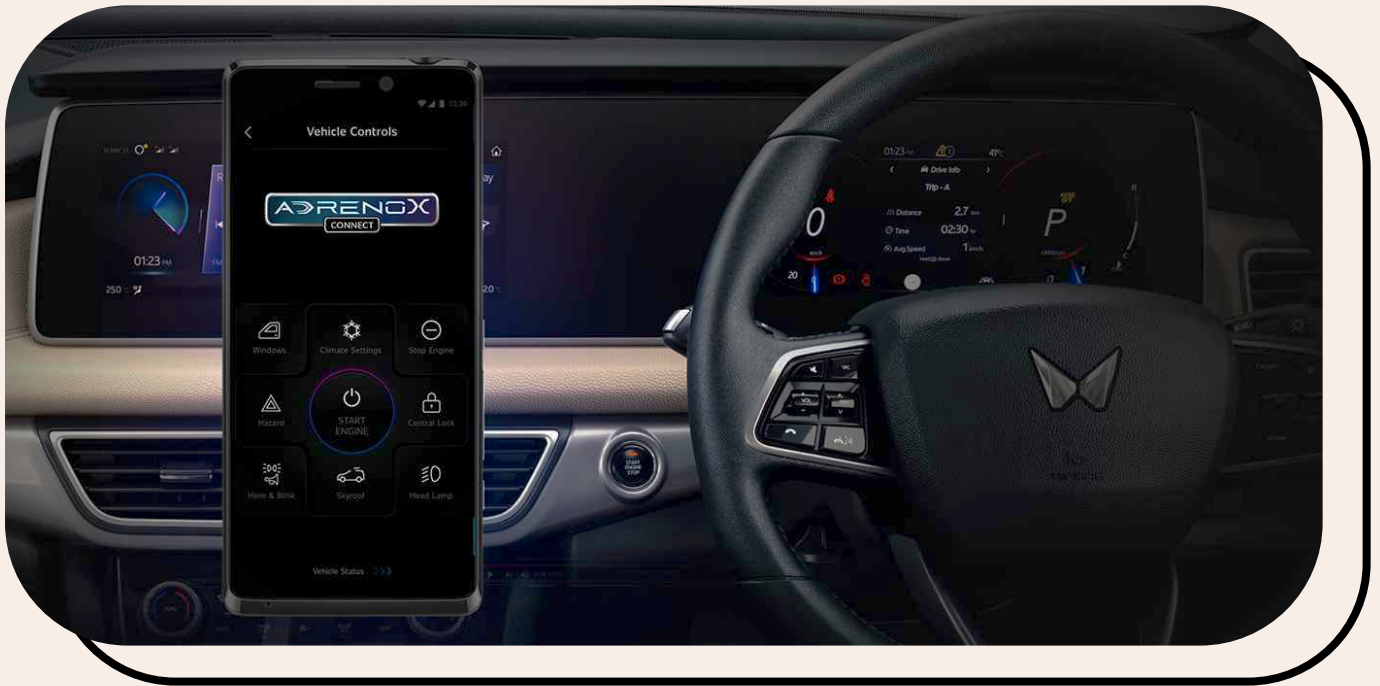
Mahindra has recently unveiled its latest SUV, the Mahindra XUV 700. And ever since the vehicle has had its official curtain-raiser, the internet is flooded with everything XUV. But more than just the refreshing looks, or the peppy powertrain, the talk of the town is the XUV's USP; the AdrenoX Connect. And for those wondering what that is, here's everything you need to know about the AdrenoX. AdrenoX is a Connected Car AI Technology, that offers over 60 connected car features and powers the dual-integrated touchscreen, on-board the XUV 700. The AdrenoX Artificial Intelligence has been developed by Bosch to offer an intuitive, immersive and totally innovative experience to the customers.

The AdrenoX platform is proudly engineered in India and is capable of both on-board and off-board connectivity. This means that AdrenoX features can be accessed both in-cabin and off-cabin as well, through smartwatches, smartphones etc.

On the face of it, the AdrenoX is teased as one of the most sophisticated and smart connected car technology that locks horns with several advanced connected car techs such as the Blue Link, Honda Connect etc. But the real test of the AdrenoX goes beyond just big collaborations. Here's the actual utility of the AdrenoX. The most important feature of the AdrenoX connected system is the fact that it offers personalised safety alerts as well driver drowsiness alert directly to the user. This feature onboard the connected car tech allows a personalised alert to be displayed, indicating the driver to slow down/stop the vehicle. This driver drowsiness detection feature is a first-in-segment offering that brings in advanced safety features that go beyond airbags. Additionally, the system also allows emergency assistance and SOS alerts as well.







In addition to safety, the connected car tech also offers comfort features like pre-setting the cabin temperature, remote control of windows, remote start/stop via smartphone/watch. Other comfort features include the journey planner, through which users can pre-plan their potential journey with added pit-stops, breaks etc. and integrate it with the navigation system. Other conventional connectivity features too are also offered on-board.

Another thing that makes the AdrenoX drool-worthy is its top-notch connectivity. Inside the cabin users can have access to a wide variety of connectivity applications, such as weather, news, travel recommendations, and even horoscope! There is also a “Smart Home” feature that lets users control and even configure their devices at home directly from the vehicle.

Moreover, for a world-class audio experience, the XUV will also come with Sony’s 3D sound technology. Other than that there is also connectivity in the shape of geo-fencing, vehicle data management etc.

So this was the ADRENEX car connected technology, and this is going to rule the forthcoming automobile industries. All other automobile industries have started to make use of this sci-fi technology in their automobiles. But first comes first rules Mahindra smashed others with this tech.

# 06 PORSCHE

## Electric Vehicles

**KRISHNAN EM**

19BME034

The hydrogen-based fuel will be ready for testing in 2022, including in the new Porsche 911 GT3 Cup race car. EVs are the future, but vehicles with internal-combustion engines are not going to disappear any time soon, which is why synthetic fuels could provide a greener option for the vast majority of the cars on the road today.

The eFuels that Porsche is testing use CO<sub>2</sub> and hydrogen ingredients and are made using renewable energy, which significantly lowers the greenhouse gas emissions compared to petroleum-based fuel.

Porsche is far from first to dip into synthetic-fuel research. Audi, Bosch, and McLaren have all been talking about and working on the technology for years.

In the race for greener mobility, nearly every automaker is now focused on electric vehicles. But buying an EV doesn't change the fact that the vast majority of cars being sold today are powered by gasoline, and they're going to remain on the road for a long time.

As a way to make driving existing vehicles more sustainable, Porsche has been working on synthetic fuels it calls eFuels that the company says can make an internal-combustion engine as clean as an EV.

Porsche's eFuels are made out of CO<sub>2</sub> and hydrogen and are produced using renewable energy. The final result is a liquid that an engine will burn the same as if it was gasoline made from crude oil, but an eFuel can be produced in a climate-neutral manner, at least in theory. Speaking at the recent launch of the new 911 GT3, Porsche vice president of Motorsport and GT cars Frank Walliser said the company will have its first small test batch—just 130,000 liters, or 34,340 gallons—of eFuel ready by 2022.

"Synthetic fuel is cleaner and there is no byproduct, and when we start full production we expect a CO<sub>2</sub> reduction of 85 percent," Walliser told the U.K. publication *Evo*. "From a 'well to wheel' perspective—and you have to consider the well-to-wheel impact of all vehicles—this will be the same level of CO<sub>2</sub> produced in the manufacture and use of an electric vehicle."

## Porsche Working on Synthetic Fuel to Make ICE Cars as Clean as EVs



One of eFuel's big benefits is that you can pump it into a standard gasoline-powered vehicle without needing to make any adjustments to the engine. Porsche's eFuel is not meant just for roadgoing vehicles, either. The newest Porsche 911 GT3 Cup race car can run on synthetic fuels, which Porsche said "significantly lowers CO2 emissions under racing conditions

"This technology is particularly important because the combustion engine will continue to dominate the automotive world for many years to come," said Michael Steiner, a member of Porsche's executive board for R&D, said in a statement in September. "If you want to operate the existing fleet in a sustainable manner, eFuels are a fundamental component."