

Lamborghini Roadmap to Electrification

18.11.2020 Bi-Rex Competence Center

Lamborghini Roadmap to Electrification

What's Lamborghini about?

Power



Sound & Emotions



Handling & Lightweight



Design

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How to preserve our Heritage accepting the Challenge?

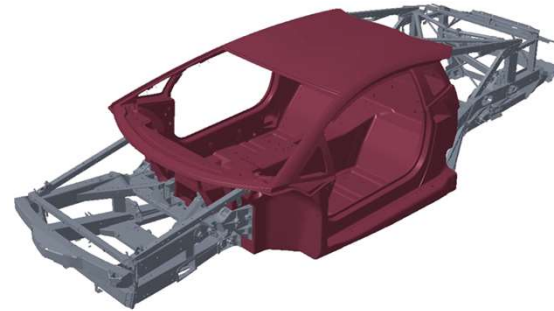
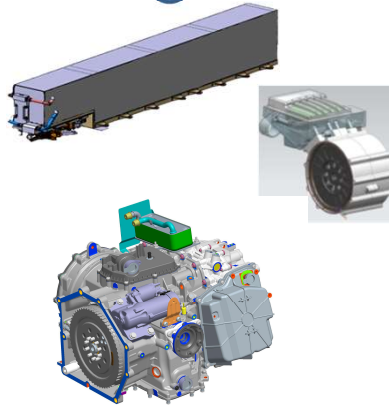
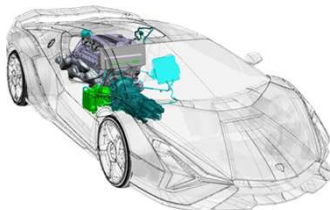


Understanding
the Challenge

Electrifying
an existing vehicle

A new modular
HV Powertrain...

...in a new modular
Platform.



Asterion,
Paris Motor Show,
2014.

LB48H,
IAA Frankfurt,
2019.

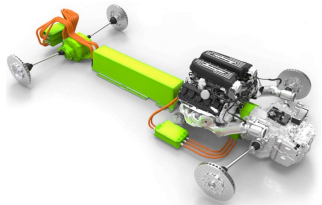
Pj1 proto
In assembly phase
Now.

Pj1

Pj2

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Understanding the Challenge



Lesson Learned:

- Vehicle electrification comes at the cost of a very high complexity (weight, variable cost, development time, safety issues).
- A fully electrified vehicle requires a completely new approach to the vehicle as a whole, where integration is the key.
- Vehicle electrification offers huge opportunities, in terms of performances (Lap time, reactivity, driveability, elasticity, CO2 emissions) and comfort (drive smoothness).
- To harvest the full potential of these technologies, a multiple step approach has to be chosen, to build in the meantime the right components, the right competences and the right approach.

A multi step approach has to be chosen, to develop competences, harvest opportunities and get the best from every level of electrification possible.

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How to electrify an existing Super Sport Car



- As mentioned, fitting a complex electrified powertrain in an existing vehicle will lead to a compromise solution (in terms of integration, costs etc).
- Are there opportunities to make a step towards electrification accepting a more simple system and the boundaries of the existing vehicle?
- Which are the major limits to be overcome?

A low voltage (48V) system can offer lightweight solution to improve comfort and performances of an existing vehicle

The limit of the battery cells have to be overcome, to maximise the power of the system without affecting the life of the accumulator.
Why not use a Supercapacitor?

Integration in the existing powertrain is a key. How small can be an electric machine?

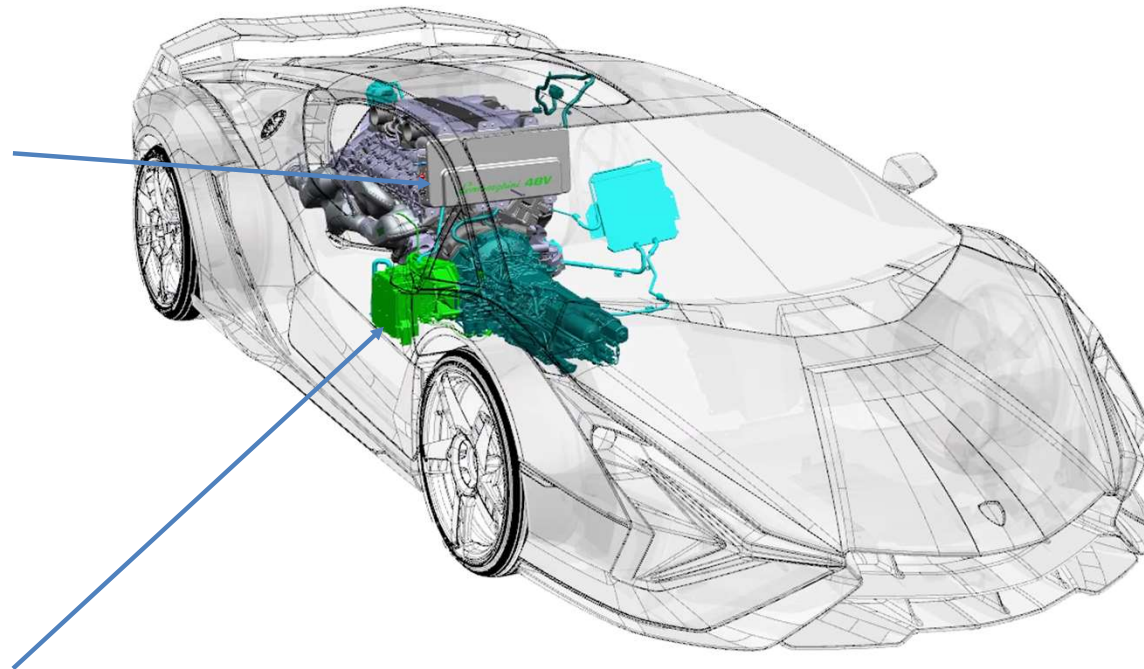


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How to electrify an existing Super Sport Car

JSR Micro supercapacitors can deliver very high power (today limited by the power electronic, not by the cell itself). This power comes at a price: low energy, suitable for HEV.

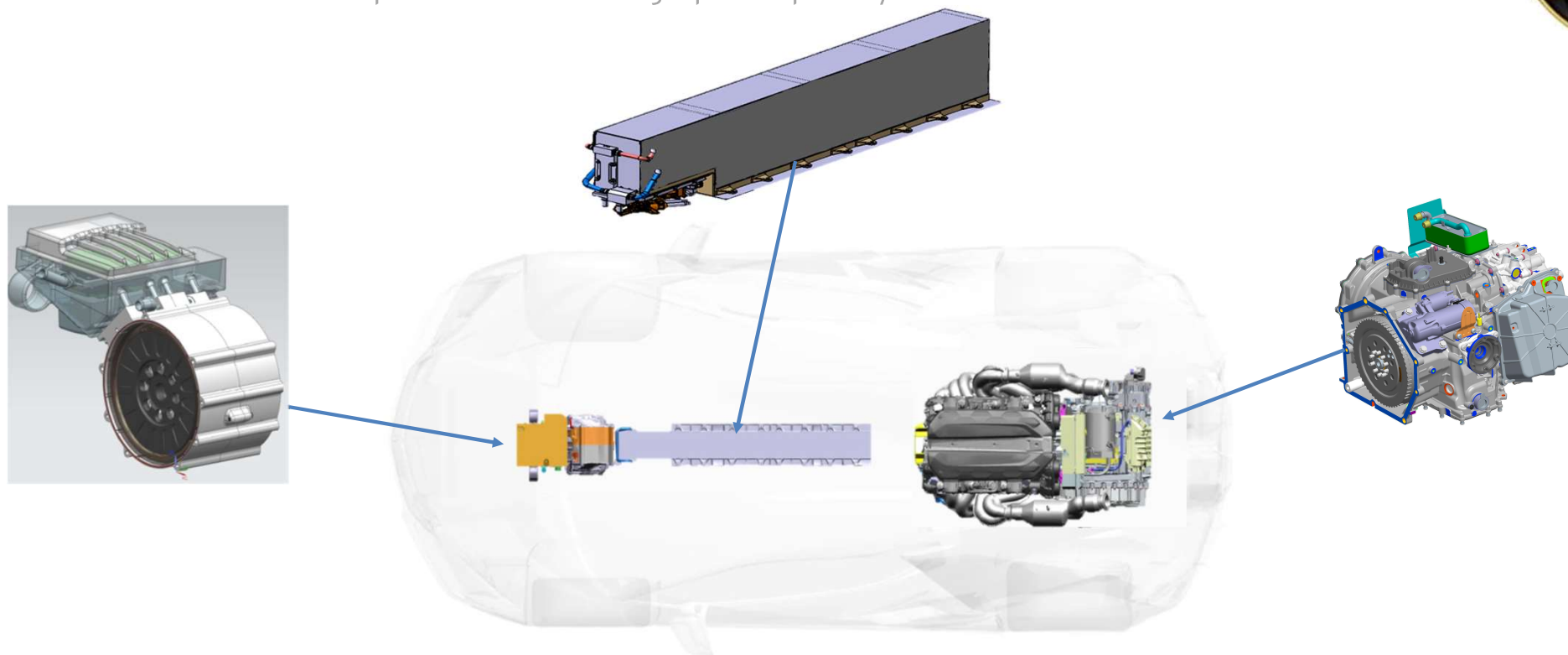
An electric motor capable of 25kW can weight less than 15kg, and connected to the Propshaft can improve the 70 - 120km/h elasticity time of more than 1,2 seconds while smoothing the torque interruption during gear shift, improving the drive comfort.



The adoption of low voltage systems is the best choice to electrify an existing, package-critical Supercar. The LB48H will be the first application of this concept, based on Supercapacitors and a 48V traction machine.

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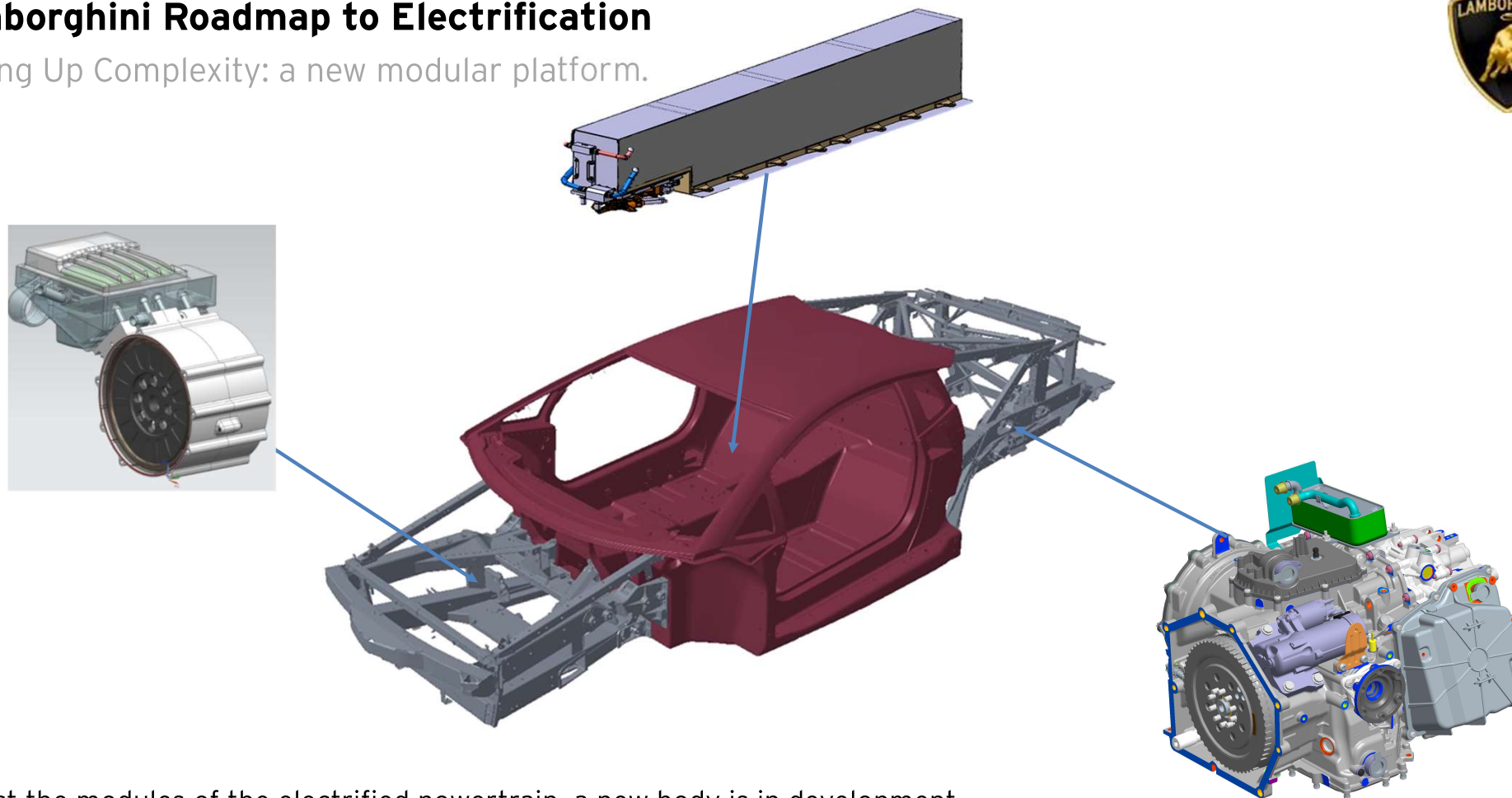
A new modular electrified powertrain: scaling up Complexity.



To harvest the whole potential of the electrification process, complexity has to be embraced. This leads to the adoption of solutions (two - machines front axle, electrified integrated gearbox) which are too complex to be fitted in an existing vehicle, and too expensive to be applied to a single model.

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Scaling Up Complexity: a new modular platform.



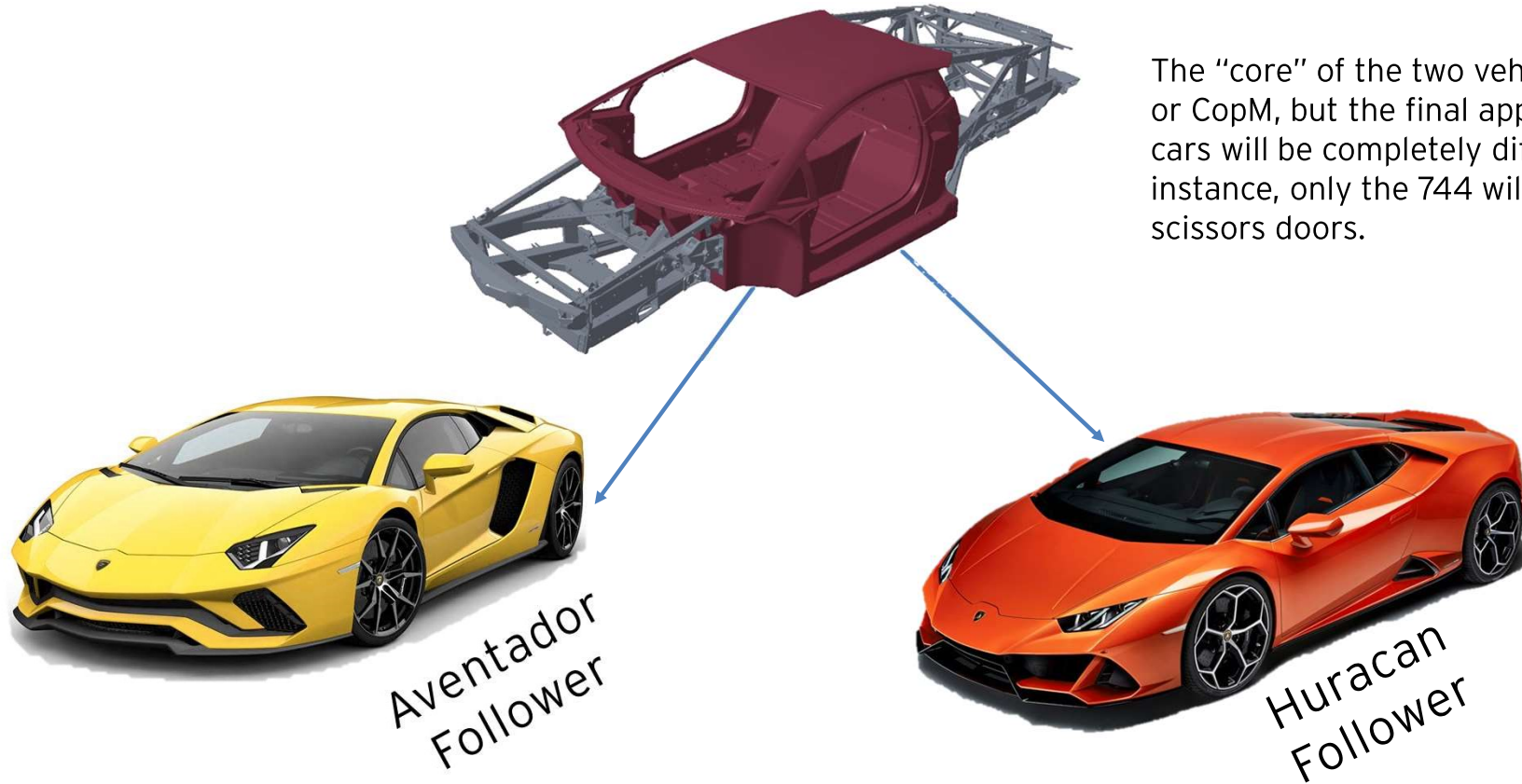
To host the modules of the electrified powertrain, a new body is in development.

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Scaling Up Complexity: a new modular platform.



The "core" of the two vehicles will be Cop or CopM, but the final appearance of the cars will be completely different. For instance, only the 744 will have the scissors doors.



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Looking to the future: the path to the "Terzo Millennio".

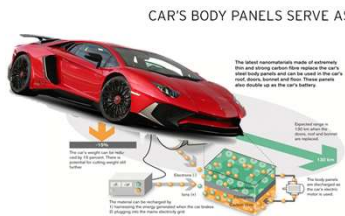
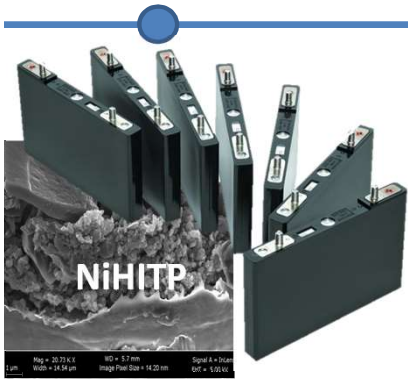


Energy Storage

Innovation in Materials

Powertrain and Vehicle architecture

Sound and Emotions



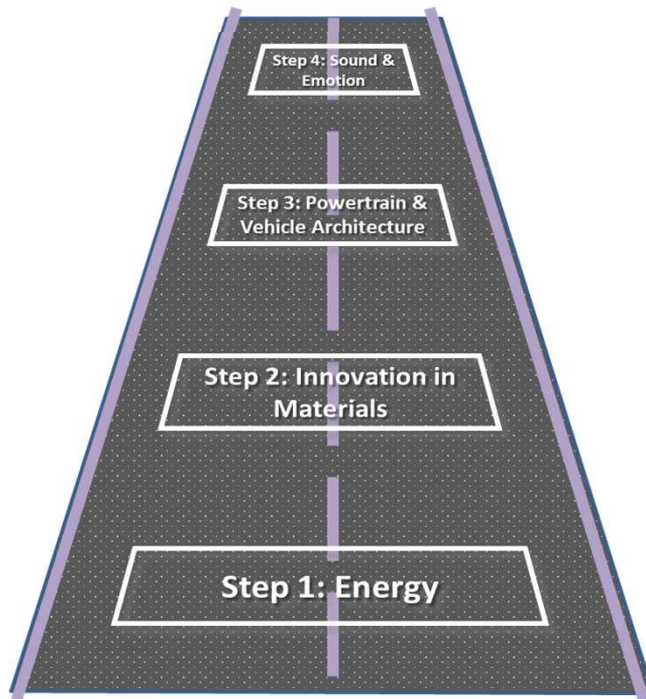
CAR'S BODY PANELS SERVE AS A BATTERY

The latest nanotechnology made of extremely thin and strong carbon fibers replaces the car's steel doors, hood and floor. These panels also function as the car's battery.



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Looking to the future: the path to the «Terzo Millennio»



To keep Automobili Lamborghini “future proof” and preserve its uniqueness, on the basis of the experience made in R&D starting from the “Asterion” on, combining existing different technologies in innovative way is not enough on the long term.

For this reason, four different research directions have been defined:

- 1: Energy
- 2: Innovation in materials
- 3: Powertrain and vehicle architecture
- 4: Sound and Emotions



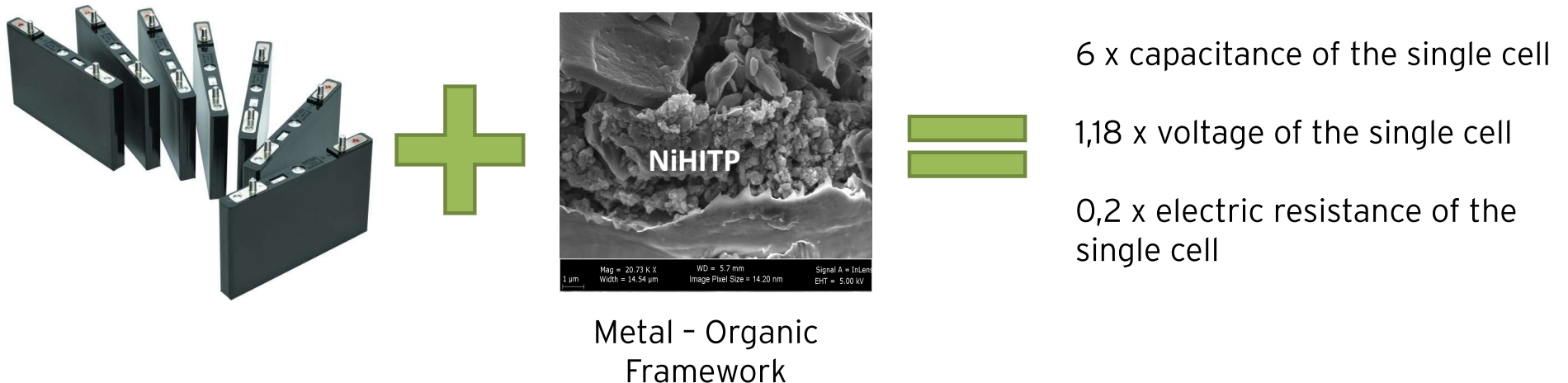
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Energy: the cooperation with the DincaLab @ MIT.

Supercapacitors are the best solution for power - intense application like vehicles, because of their high power density, resistance to cycling, low electric resistance and symmetric charge / discharge behaviour.

Target of one of the two project in cooperation with the Massachusetts Institute of Technology is to close the gap between batteries and supercapacitors in terms of energy density.

Compared with today's JSR Micro cell applied in the 48V application we want:



At the moment, the research program is on the path to reach the targets (could it be an alternative to the Li-Ion battery cells...?)

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Powertrain and Vehicle Architecture: In - wheel e-motors



In - wheel e-motors. Can a very old idea become modern again?

The electric propulsion for passenger vehicle did, few years ago, on the pressure of innovative batteries.



The opportunities are huge. The problems to overcome too, starting from the negative impact of non - suspended masses. Will the modern active control systems (able to read the road) allow to resume an old, good idea?

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Sound and Emotions, Imagining the sound of silence. Cooperation with Pheel Lab, PoliMi.



Can we measure (and replicate...) emotions?

Maybe yes. And if we can measure them, we can understand why we like the sound of a V12NA engine and perhaps find a way to replicate the same emotion with a "more electric" motor.



For the first time we're trying to measure and define in a physical way the reaction of our body to the sound of our engines. This, alone, is a great challenge. Our target is even bigger: reproduce the same effect, without the engine (and without cheating with playback...).



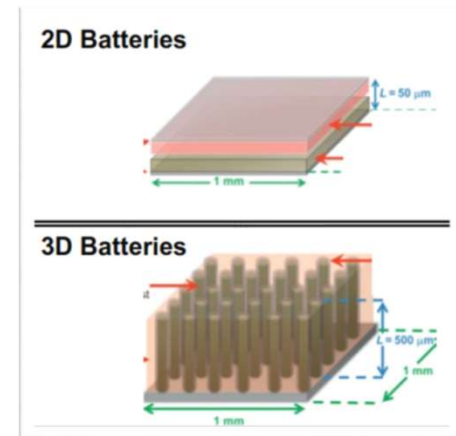
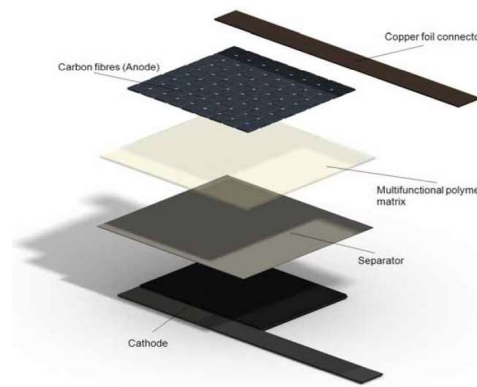
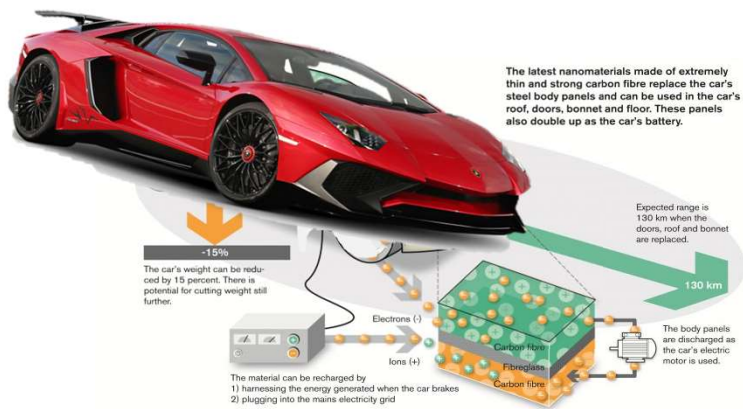
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Innovation in Materials: the cooperation with the Mechanosynthesis Lab @ MIT.

Most of the materials in the structure of a vehicle are just... structure.

May we ask them to do more? For instance, to store electrical energy?

CAR'S BODY PANELS SERVE AS A BATTERY



The use of carbon Nanotubes allows to realize a 3D Battery. Now the question is, can we shape it into a Lamborghini?

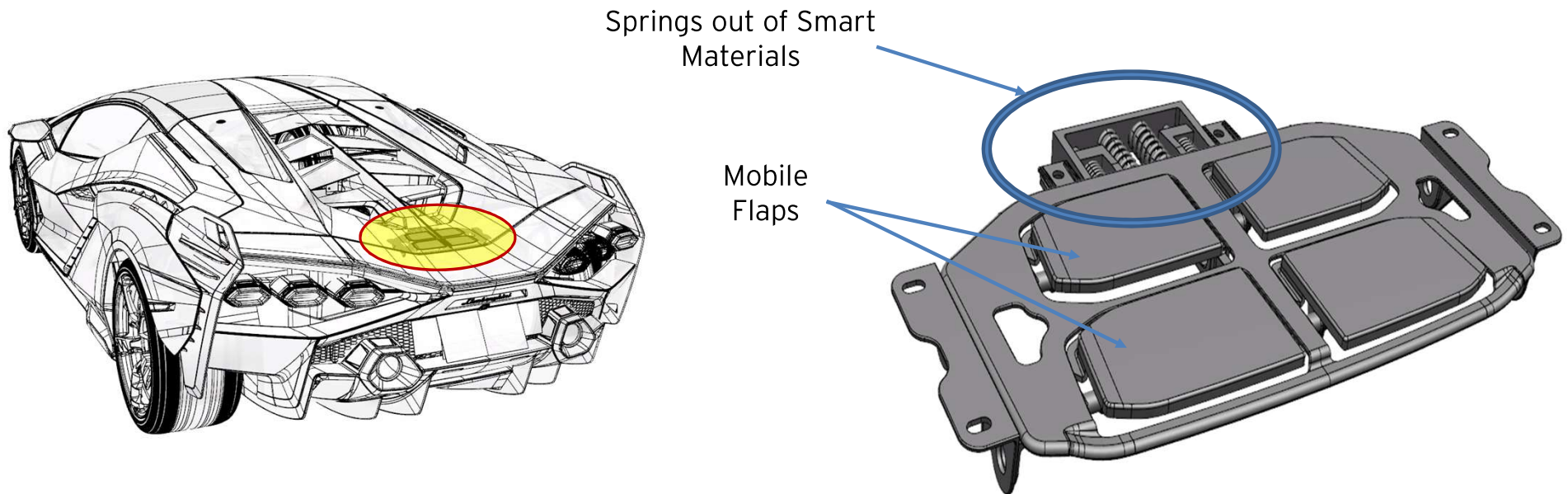


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Innovation in Materials: the application of Smart Materials

Can materials react to ambient?

“Smart materials” can. They switch between two geometries according with the ambient temperature.



No need of external controls, sensors, wiring etc. The more elegant way to actuate a mobile surface.

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Conclusion



«Se vogliamo che tutto rimanga com'è,
bisogna che tutto cambi»

Giuseppe Tomasi di Lampedusa, «Il Gattopardo»

Thank You for your attention.