

EDUCATION : A POWERFUL MEAN FOR MATERIAL DIFFUSION TOWARDS SOCIETY

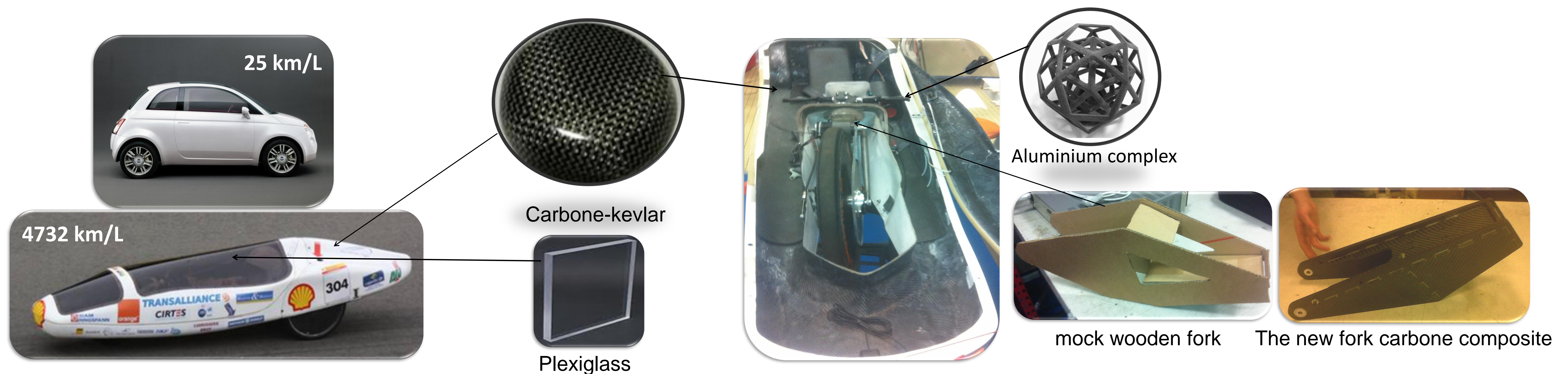
Yannick Deliere, Julien Pallas, Mathias Mellinger, Matthieu Personni, Arnaud Delebarre, Gérard Déchenaud et Jean-Michel Rivière
ESSTIN, 2 rue Jean Lamour F-54519 Vandœuvre-lès-Nancy Cedex, France

www.esstin.univ-lorraine.fr/
www.ecomotionteam.org/blog/
A. Delebarre*, adelebar@univ-lorraine.fr
* Corresponding author

➤ 1 Education by project

- **ESSTIN**, Ecole Supérieure des Sciences et Technologies de l'Ingénieur de Nancy. Students have to manage a project during their third and fourth years. The Eco Motion Team *by* ESSTIN is a team project with the aim to build an environmental friendly vehicle to participate to **Shell Eco Marathon competition**. The purpose is to drive a maximum distance with the less energy.

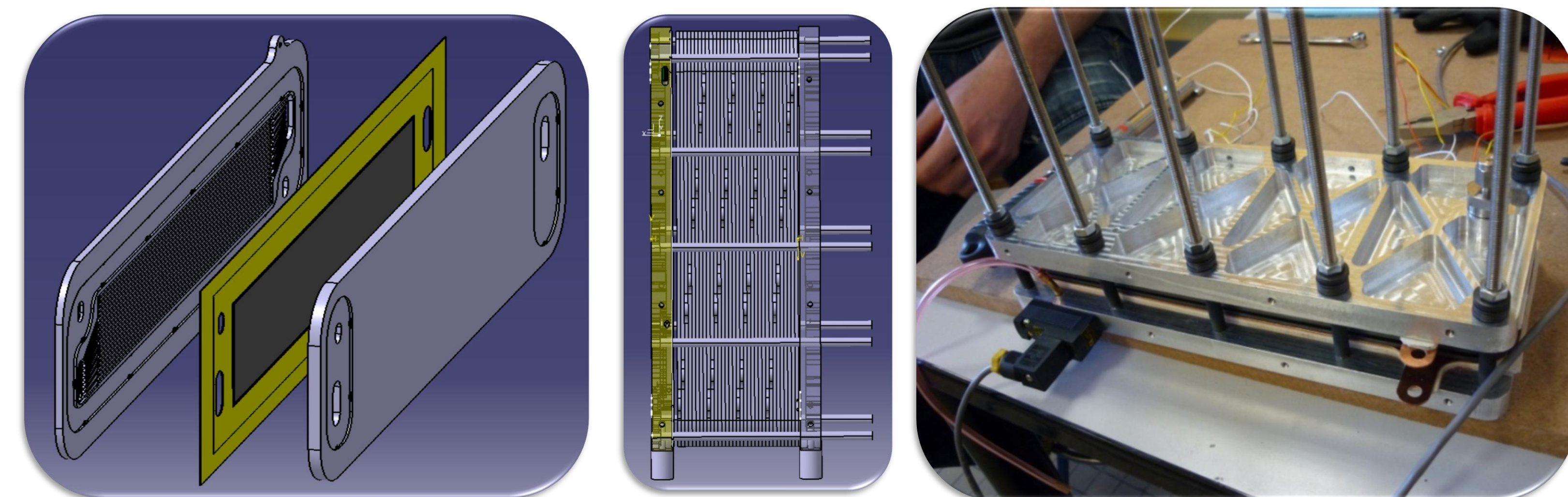
- In 2010, ESSTIN developed a fuel cell to race in the hydrogen category and scored a **consumption of 2379 km/l** (gasoline equivalent) – this fuel cell is still undergoing development works.
- In 2011, the team developed another prototype vehicle, using materials that allow low weight, such as Kevlar mixed with Carbon to avoid uncontrolled and dangerous dismantle. Handlebar was made by combining Titanium, Polyamide, Aluminium powders by laser melting process. The material is as strong as aluminium and as light as plastic. The vehicle raced in battery category and attained a **consumption of 4732 km/l**.



➤ 2 The achievement of the fuel cell

Concerns the development that meets the **requirements of competition and of high energy efficiency** :

- To produce a fuel cell, more **efficient, economical, compact** and with **less energy consumption** than others available on the market.
- Eco Motion Team of ESSTIN associated with an industrial partner, a research laboratory (LEMTA) have thus developed a fuel cell with **low power consumption** thanks to more energy-efficient control systems.
 - the electronic smart card controls the air blower to get an optimum output
 - a passive air humidifier is used to improve the chemical reaction
- Dimensioned to operate at **24V, <0.1A/cm²**, 80cm² of active area, 60 ° C, atmospheric pressure, **without H₂ purge**. In addition, a **lower maintenance cost** is also an outcome of this project.
 - We machined the polar plates ourselves, no need to buy spare parts and we can work directly on it and adapt the parameters to our conditions.
- To be able to repair it and dispose of spare parts during the competition



➤ 3 Responsible engineering

- The study and design of the fuel cell involve and train students in problem solving concerning **renewable energy and eco mobility**. Beyond the application to an energy-friendly vehicle, the goal is to realize a demonstrator of an **electric power generator** operating with a fuel cell for powering portable devices.
- In the scope of investigating new materials and their outcomes, ESSTIN wishes to get students **to work in the field of nanotechnology**. During their fourth year, they have practical work on a platform with an atomic force microscope and an tunneling microscope .
- To conceive and to product new materials must be accompanied by teaching programs to train new generation of engineers able to handle with them.

