Application No. 613: Ultralight vehicle for Shell Eco Marathon

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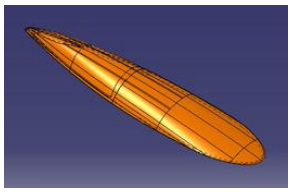
Fastening the top of an ultralight vehicle

Video

The Shell Eco Marathon

In 2012, the eco team of the student club TUfast at the Technical University Munich participated in the Shell Eco Marathon. This is an annual international competition geared towards pupils and students. Participants are charged with developing and building a very energy-efficient vehicle.

Fastening the top of the vehicle



The central problem in the conception of our ultralight vehicle was fastening the top of the vehicle. Not only did it have to be feasible, it also had to adhere to the security guidelines of the competition: According to the rules, the driver should be able to leave the vehicle within 10 seconds in case of an emergency.

The closing mechanism should have the following features:

- Despite vibrations due to unevenness in the road, the top needs to stay on tightly.
- In case of an emergency, you have to be able to open the top in less than 2 seconds.

The search for a suitable construction was not easy. Many locking methods with metals or springs turned out to be too heavy, too unwieldy or simply not reliable. Even the use of magnets appeared to be inappropriate at first. That would have required a ferromagnetic binding partner in the carbon fibre chassis. But there were no provisions for that.

The solution with magnets

Then we found the solution: The carbon fibre flange for fastening the top was thin enough (< 0,6 mm) to be bridged with magnetic strength. After a quick Internet search we found magnets at www.supermagnete.fr that had the needed adhesive force of at least 10 N/ piece as well as a temperature stability of up to 180°C. That was important because during the fabrication of the carbon fibre parts the magnets were likely exposed to temperatures of approx. 140°C. The friendly and straightforward supermagnete team encouraged us to pursue the fastening with magnets option.

After a detailed research, we found the block magnets Q-25-06-02-SN (www.supermagnete.fr/eng/Q-25-06-02-SN) with a maximum working temperature of 150°C to be suitable. After careful preparation of the surface (grinding and cleaning) we glued the magnets on the edge of the vehicle top (see picture above) and on the edge of the vehicle chassis (see adjacent picture). Altogether, we used 12 magnet pairs.

A successful race

During the competition the magnet construction had ample opportunity to prove its capability. The vehicle top was steadily fastened, yet quick to open.

According to Shell, there were 40 000 visitors attending. In the paddock, a huge hall that served as a pit walk, we were able to present our vehicle to many interested visitors. The interest they showed was not only in our vehicle and its appealing paintwork: They also marveled at our professional presentation of the detailed technical solutions with the help of roll-ups.

The TUfast eco team achieved a range of 570 km/ kWh or 5100 km/ l petrol equivalent and made 4th place. These values at our first participation in the Shell Eco Marathon 2012 helped us score in the battery class. We managed to reach the full potential of our vehicle and generated enormous awareness for our team.

Articles used
24 x Q-25-06-02-SN: Block magnet 25 x 6 x 2 mm (www.supermagnete.fr/eng/Q-25-06-02-SN)

Online since: 19/10/2012