Hybrid vehicles get S-in motion® weight savings

New study demonstrates lightweight potential of advanced steels in hybrid vehicles

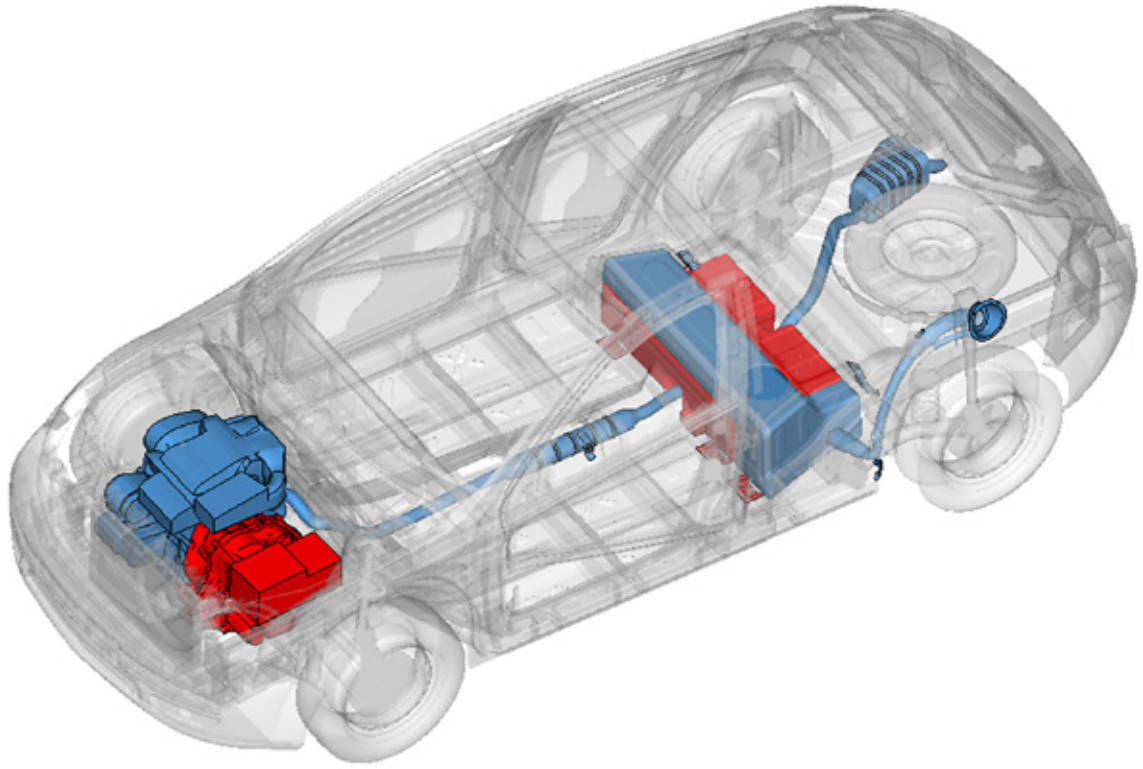
Tighter emissions regulations have led carmakers to explore different powertrain options for their vehicles. Despite an early focus on fully electric vehicles, most automotive analysts and manufacturers now agree that they will make up less than 10% of the global fleet by 2020. Instead, hybrid powertrains will offer the best cost-benefit compromise for OEMs while meeting consumer demand for unlimited range.

Hybrid powertrains present unique challenges for car designers. As well as accommodating a conventional internal combustion engine (ICE), the vehicle also has to carry a battery and electric motor. This adds almost 200 kilograms to the weight of a typical C-segment vehicle and requires additional reinforcement in the body-in-white (BIW) structure.

S-in motion® applied to plug-in hybrids

These constraints led ArcelorMittal to adapt our **S-in motion® solutions** to plug-in hybrid electric vehicles (PHEVs). S-in motion® has already proven that significant weight savings are possible in the BIW of conventional ICE vehicles and pick-up trucks through the use of advanced high strength steels (AHSS) and technologies such as laser welded blanks (LWBs).

The **S-in motion® PHEV study** showed that it was possible to decrease the BIW weight by increasing the use of AHSS (including hot stamped press hardened steels) to 57%, up from 37% in the baseline vehicle. The number of LWBs was more than doubled to 18 parts (up from 8) and hot stamping was utilised in 31% of the BIW (up from 6%). LWBs are an effective way to reduce weight while still maintaining performance by putting exactly the right steel in the right place.



Two powertrains – a conventional ICE engine (blue) and an electric motor and battery (red) – add significant weight and complexity to the BIW of a PHEV.

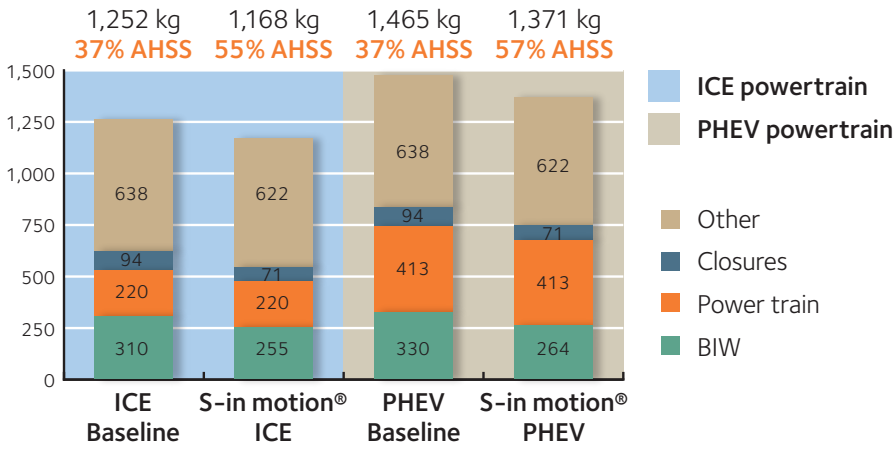
The final results of the S-in motion® Plug-in Hybrid Electric Vehicle (PHEV) study showed that ArcelorMittal's advanced steels and solutions have the potential to cut 55 kg (17%) from the BIW, leaving it just 9 kg heavier than the lightest ICE BIW.

Press hardened steels (PHS) are utilised for 24 parts of the PHEV BIW, mainly **Usibor®** 1500 and Ductibor® 1000. PHS offer high mechanical resistance for complex geometries without springback.

Weight saving at little cost

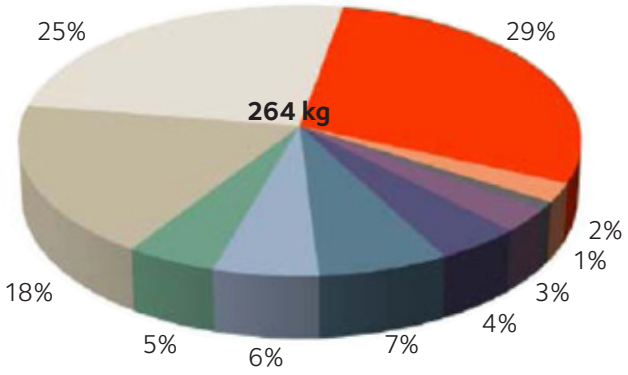
A significant challenge was ensuring that the optimised PHEV could meet 2015 Euro NCAP load cases in side, pole, and front offset crash scenarios. The pole crash test is one of the most difficult to satisfy as the PHEV has additional weight in the front (electric motor) and the back (battery pack). The solution was to make a hot stamped cross member from Usibor® 1500. This offers outstanding protection against side impacts.

The final results of the S-in motion® PHEV study showed that ArcelorMittal's advanced steels and solutions have the potential to cut 55 kg from the BIW, leaving it just 9 kg heavier than the lightest ICE BIW. S-in motion® again proves that advanced steels have the potential to dramatically reduce vehicle weight while improving safety, and at neutral cost to the carmaker despite the higher cost of PHS and LWBs.



The BIW of the S-in motion® PHEV weighs just nine kilograms more than that of an optimised S-in motion® ICE solution.

Baseline weight breakdown / final weight breakdown



The increased use of ArcelorMittal's advanced high strength steels can reduce the BIW weight of a PHEV by 55 kilograms, resulting in a very light BIW and structure weighing just 264 kg.

57% AHSS

Processes

Hot stamping..... 24 parts
Stamping of LWB.. 18 parts
Roll forming..... 3 parts

Tensile strength

- PHS > 1,300 MPa
- PHS > 450 MPa
- AHSS > 1,500 MPa
- AHSS 1,180 MPa
- AHSS 900 MPa
- AHSS 780 MPa
- AHSS 590 MPa
- AHSS 450 MPa
- HSS
- Mild Steel

More info:

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