Global Steel Industry Project Provides Light Weight, Low Carbon Footprint Vehicle Options

Advanced High-Strength Steels Combined with Electrified Powertrains Reduce Weight, Emissions, Improve Safety without Cost Compromise

Brussels, 18 May 2011 – WorldAutoSteel announced today the results of a three-year programme to develop fully engineered, steel-intensive designs for electrified vehicles that reduce greenhouse gas emissions over their entire life cycle. The FutureSteelVehicle (FSV) features steel body structure designs that reduce mass by more than 35 percent over a benchmark vehicle and reduce total life cycle emissions by nearly 70 percent. This is accomplished while meeting a broad list of global crash and durability requirements, enabling five-star safety ratings, while avoiding high-cost penalties for mass reduction.

The FSV programme developed optimised Advanced High-Strength Steel (AHSS) body structures for four proposed 2015-2020 model-year vehicles: battery electric (BEV) and plug-in hybrid electric (PHEV) A-/ B-Class vehicles; and PHEV and fuel cell (FCEV) C-/D-Class vehicles.

“FutureSteelVehicle taps into the best attributes of steel – its design flexibility, its strength and formability, its low manufacturing emissions and its comparative low cost,” said Jody Shaw, chairman, FSV programme and director of technical marketing and product research at United States Steel Corporation. “Though FutureSteelVehicle’s development focused on electrified powertrains, a broad bandwidth of steel applications have been produced that can be used to reduce mass and life cycle emissions for any type of automobile.”

The FSV programme brings more advanced steel and steel technologies to its portfolio, including more than 20 new AHSS grades, representing materials expected to be commercially available in the 2015 – 2020 technology horizon. The FSV material portfolio includes dual phase (DP), transformation-induced plasticity (TRIP), twinning-induced plasticity (TWIP), complex phase (CP) and hot formed (HF) steels, which reach into GigaPascal-strength levels and are the newest in steel technology offered by the global industry.

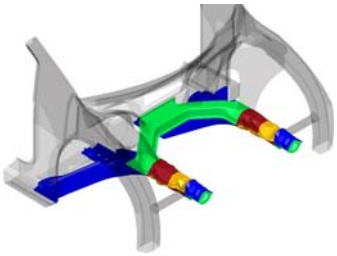
Steel’s design flexibility makes best use of the design optimisation process that develops non-intuitive solutions for structural performance. The resulting optimised shapes and component configurations often mimic Mother Nature’s own design efficiency, where structure and strength are placed exactly where they are needed for the intended function. FSV’s steel portfolio is utilised during the material

selection process with the aid of full vehicle analysis to determine material grade and thickness optimisation.

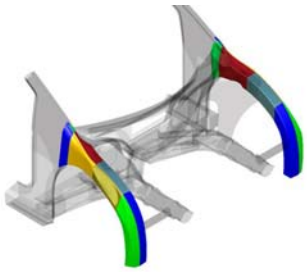
Consequently, the FSV concepts are very efficient and very light weight. FSV's BEV concept weighs 188 kg and reduces mass by more than 35 percent over a baseline ICE body structure adjusted for a battery electric powertrain and year 2020 regulatory requirements. FSV's A-/ B-Class PHEV20 vehicle weighs 175 kg, and the larger C-/ D-Class vehicle versions weigh 201 kg.

Non-intuitive structures can be seen throughout the FSV structures. A few examples are:

- **Front Rail Sub-System** (see FrontRail.jpg) is a new design for automotive front crash structures. The unusual section shape of the rails was a result of the design optimisation methodology that improved the effectiveness of each steel element to achieve minimum mass and best crash management performance. It is manufactured using a laser welded blank with varying gauges of TRIP material.



- **Shot Gun Sub-System** (seeShotGun.jpg) resembles a shot gun-type rifle and provides superior performance in both full frontal and offset crash simulations. The Shot Gun is comprised of a three-piece hot formed steel tailor welded blank of varying thicknesses, manufactured using hot stamping with tailor quenching.



- **Rocker Sub-System** (see Rocker.jpg) are manufactured using roll-formed complex phase (CP) steels of GigaPascal strength. Resembling a skeletal bone, the rocker enabled excellent results in four different side crash simulations that are a combination of global requirements.

Included as an integral part of the design optimisation process are crash analyses that encompass the most severe global requirements. FSV meets or exceeds the structural requirements, and thereby enables the achievement of five-star safety ratings in final production vehicles.

"Achievement of such aggressive weight reduction accomplished with advanced steels and design optimisation will set a new standard for vehicle design approaches for the future," said Cees ten Broek, Director, WorldAutoSteel. "Key to our Phase 2 evaluations of different structural options is a life cycle assessment based on the University of California at Santa Barbara (UCSB) Greenhouse Gas Materials Comparison Model," said ten Broek. "FSV reduces emissions in anticipation of future legislation and requirements around the world. The steel industry as a whole feels the responsibility to

lead the way in demonstrating the use of steel and life cycle assessment to reduce vehicle carbon footprint."

A life cycle assessment (LCA) approach assists automakers in evaluating and reducing the total energy consumed and the life cycle greenhouse gas emissions of their products. Regulations that consider only the vehicle use phase can encourage use of low-density, greenhouse gas-intensive materials that may, in some applications, provide lighter weight components that improve fuel economy and tailpipe emissions. However, this may have the unintended consequence of increasing greenhouse gas emissions during the vehicle's total life cycle.

It is noteworthy that, based on the new steels' lightweighting capabilities, steel is the only material to achieve reductions in all life cycle phases. As the automotive industry's efforts to reduce carbon dioxide equivalent (CO_2e) emissions increasingly move towards more advanced powertrains and fuel sources, material production will account for a much larger percentage of total life cycle emissions.

The FSV programme is the most recent addition to the global steel industry's series of initiatives offering steel solutions to the challenges facing automakers around the world to increase the fuel efficiency of automobiles and reduce greenhouse gas emissions, while improving safety and performance and maintaining affordability. This programme follows the UltraLight Steel Auto Body 1998, the UltraLight Steel Auto Closures 2000, UltraLight Steel Auto Suspension 2000, and ULSAB-AVC (Advanced Vehicle Concepts) 2001, representing nearly €60 million in research and demonstration investment.

About WorldAutoSteel

WorldAutoSteel, the automotive group of the World Steel Association, is comprised of 17 major global steel producers from around the world.

WorldAutoSteel's mission is to advance and communicate steel's unique ability to meet the automotive industry's needs and challenges in a sustainable and environmentally responsible way. WorldAutoSteel is committed to a low carbon future, the principles of which are embedded in our continuous research, manufacturing processes, and ultimately, in the advancement of automotive steel products, for the benefit of society and future generations.

To learn more about WorldAutoSteel and its projects, visit www.worldautosteel.org

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- Anshan Iron and Steel Group Corporation – China
- Arcelor Mittal - Luxembourg
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