

Automotive Manufacturing Trends:

Meeting the 54.5 MPG Target

2016: Fuel prices are unexpectedly low, large trucks are still in high demand, and electric and hybrid vehicles haven't yet been fully adopted on a large scale. However, with 2025 CAFE standards looming on the horizon, auto manufacturers have a steep challenge ahead of them. In order to meet 54.5 mpg and increased safety requirements, automakers will have to design and develop lighter, safer, and more powerful vehicles. Joining and formability of new materials and design concepts will be critical to addressing industry challenges.

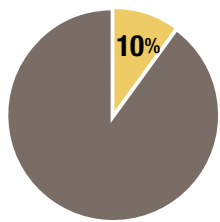
The global market for lightweight materials used in transportation is expected to reach approximately

\$188.7
billion by 2020¹

Smaller, more powerful combustion engines

Advance transmission design

- ▶ Among new vehicles with automatic transmissions, more than 10 percent now have CVTs²



- ▶ New focus on weight reduction of transmissions

Increased electrification

Electric and hybrid vehicles

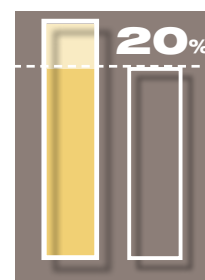
- ▶ Electric and hybrid vehicles produce around half the well-to-wheel greenhouse gas emissions of conventional vehicles³



Steel advancements

Growth of UHSS

- ▶ Weight reductions of 20% have been achieved with UHSS⁴
- ▶ Gen 3 steels which offer more improved strength-to-weight ratios are now being developed



Down gauging of frames using AHSS

- ▶ AHSS use expected to nearly double by 2025⁵
- ▶ Lighter, thinner chassis designs challenge approaches to welding, NVH, and durability performance

Continuous in-flux of alloys

- ▶ Need for low-cost FEA-based weldability tools

Weldability and formability challenges

- ▶ Welding development for Gen 3 steels
- ▶ GMAW, brazing, LBW

Aluminum advancements

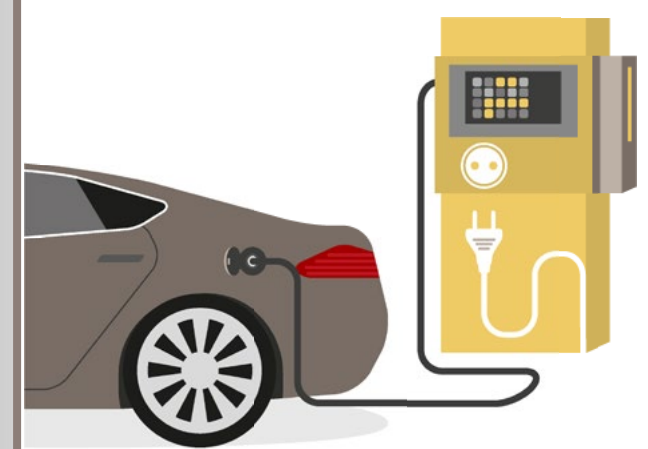
Joining and forming challenges

- ▶ Development of production welding practices to move away from the use of rivets
- ▶ Need to establish warm/hot forming practices

Multi-material vehicles

Joining of dissimilar materials

- ▶ OEMs adopting multi-material strategies that will create joining challenges
- ▶ Need to develop tools for modeling of multi-material vehicles



TO ECONOMICALLY ADDRESS THESE TRENDS AND CHALLENGES, the auto industry will need direct access to applied engineering expertise and innovative manufacturing solutions. EWI's extensive R&D in lightweight material applications—advanced high-strength steels, high-strength aluminums, magnesium, and composites—helps manufacturers across all tiers. Contact Jon Jennings, Business Development Director, at jjennings@ewi.org or **614.688.5144** to find out how EWI can help you stay ahead of the competition.

¹<http://www.bccresearch.com/market-research/advanced-materials/lightweight-materials-transportation-report-avm056d.html>
²http://www.washingtonpost.com/cars/your-next-vehicle-is-more-likely-to-have-a-cvt-heres-why/2014/05/27/76abd984-e5b4-11e3-a70e-ea1863229397_story.html
³http://www.afdc.energy.gov/vehicles/electric_emissions.php
⁴<http://www.automotivemanufacturingsolutions.com/process-materials/manufacturing-with-uhss>
⁵<http://www.autosteel.org/~media/Files/AutoSteel/Great%20Designs%20in%20Steel/GDIS%202015/Track%202%20-%20Abraham.pdf>