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The steel deal: lightweighting the future of EVs

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Summary of podcast with WorldAutoSteel

This analysis summarizes insights from an Autology podcast hosted by Matthew Beecham exploring the evolving role of advanced high-strength steels (AHSS) in the automotive industry. Joining him are Mengyin Tao, Principal Research Analyst for Materials at S&P Global Mobility, and Ingo Olschewski, Director of WorldAutoSteel, representing a coalition of leading steel producers. Their discussion centers on how AHSS is shaping the future of vehicle design, safety, efficiency and sustainability.

The strategic importance of AHSS in electrified vehicles: Olschewski opens the conversation by highlighting the increasing relevance of AHSS in electric vehicles. The battery — adding 180-320 kilograms to a vehicle — presents a critical challenge for automakers seeking to maintain range and performance through lightweighting. AHSS offers a superior strength-to-weight ratio at a lower cost compared with alternative materials, making it an attractive solution for OEMs. Furthermore, as safety requirements intensify, AHSS enables robust crash protection, especially for battery packs, through engineered ductility and predictable energy management in crash scenarios.

Thermal management and battery enclosures also benefit from AHSS. Steel is ideal for containing battery fires and thermal runaway events due to its stiffness, fire resistance and compatibility with joining and sealing systems. However, Olschewski notes that advancements in battery chemistry, such as the shift toward solid-state batteries, may alter these requirements. The steel industry is proactively preparing to address these changes through strategic studies beginning in 2026.

Cost pressure remains a significant factor in EV adoption. Batteries dominate the cost structure, compelling OEMs to aggressively reduce costs across other vehicle systems. AHSS stands out for its affordability, ease of production and repair, compatibility with existing manufacturing infrastructure, recyclability and low embodied carbon — positioning it as a cornerstone material for future mobility.

Global electrification trends and material challenges: Tao provides a global perspective, noting that electrification is an irreversible trend, with mainland China leading the charge and Europe and North America adjusting timelines for CO2 emission targets. By 2032, S&P Global Mobility forecasts that pure EVs will account for over 50% of new vehicle production in Europe and Greater China, and 35% in North America. The proliferation of batteries, sensors and smart devices in vehicles intensifies the need for lightweight materials that do not compromise safety or handling.

The structural design of EVs diverges significantly from traditional internal combustion engine vehicles, requiring flat floors for battery placement and new reinforcement strategies. AHSS enables these innovations, offering flexibility in part design and the ability to optimize performance and cost.

Body-in-white structures: Beecham raises the topic of aluminum mega castings, which have gained popularity for simplifying production and reducing part counts. Olschewski acknowledges aluminum's advantages but argues that AHSS offers alternative integration pathways, such as tailor-welded blanks and hot-stamped "mega shells." These methods enable local reinforcement, reduce complexity, and leverage existing manufacturing infrastructure, thereby avoiding the high capital expenditure associated with aluminum casting.

Repairability is another key advantage of AHSS; steel modules can be repaired using conventional

techniques, whereas aluminum castings often cannot. In crash performance, tailored AHSS components outperform other materials in energy absorption and load path tuning. Tao adds that while aluminum casting is effective for lightweighting, it faces challenges in up-front investment, production quality and repairability. In contrast, AHSS integration is versatile, cost-effective and supported by mature supply chains, particularly in mainland China, where OEMs like BYD utilize tailored rolled blanks for battery cases and structural rails.

Beyond the body: The lightweighting trend extends beyond body-in-white to other vehicle systems. Olschewski highlights opportunities for AHSS in chassis components, including suspension arms, subframes and seating structures. These components must manage increased battery mass, higher torque from electric motors, and NVH (noise, vibration, harshness) challenges. AHSS enables lightweight hollow members, tailored thicknesses, and high crash performance. In seating structures, ultra-high-strength steel frames deliver mass reduction, enhanced dynamic comfort, and improved side impact protection. Underbody and thermal systems also benefit from AHSS's fire resistance and formability.

Material competition: Tao discusses the competitive landscape for battery case materials. Mixed-material solutions are standard, with some OEMs preferring full steel (e.g., GM's Ultium platform, Toyota's BZ4X, Hyundai/Kia) and others favoring aluminum (BYD, Geely, NIO, Volkswagen's MEB platform). Aluminum offers lightweighting and integrated cooling channels, while AHSS provides superior torsional stiffness, lower cost, and supply chain reliability. The future may see parallel trends: increased use of press-hardened steel and the emergence of large aluminum giga castings for battery cases, though the latter requires massive machinery.

Sustainability: Olschewski emphasizes steel's strong position in sustainability. As OEMs shift focus from mass reduction to life cycle assessment and CO2 emissions, steel's lower embodied carbon and recyclability become decisive advantages. Primary aluminum production is more CO2-intensive, and polymers/carbons are even less sustainable.

New material demands: Autonomous driving will reshape vehicle engineering priorities, demanding higher structural rigidity, tighter tolerances and long-term durability to support sensor accuracy and commercial fleet usage. Both Tao and Olschewski agree that AHSS will be essential for passive safety, crash absorption and battery protection in mixed traffic environments. Olschewski introduces WorldAutoSteel's Steel eMotive concept — a fully AHSS-bodied autonomous vehicle designed for urban mobility as a service. This concept demonstrates AHSS's advantages in crashworthiness, durability, cost efficiency and architectural flexibility for Level 4/Level 5 driverless vehicles.

Innovations in AHSS fabrication and end-user benefits: Tao concludes by highlighting recent advancements in AHSS fabrication, notably door ring and hydroforming technologies. Door rings made from ultra-high-strength steels are now standard in high-end and mid-class vehicles, offering superior occupant protection. Hydroforming enables complex, lightweight and strong components, replacing multiple stamped parts with a single piece. These innovations are widely adopted by global OEMs, including Ford and Nissan, and are expected to proliferate further.

Conclusion: This episode underscores AHSS's critical role in meeting the automotive industry's evolving demands for electrification, safety, lightweighting, cost efficiency and sustainability. With mature supply chains, ongoing innovations and strategic advantages in emerging vehicle architectures — especially autonomous mobility — AHSS is poised to remain a foundational material in automotive design and manufacturing for years to come.

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