Steel Market Development Institute

FACT SHEET

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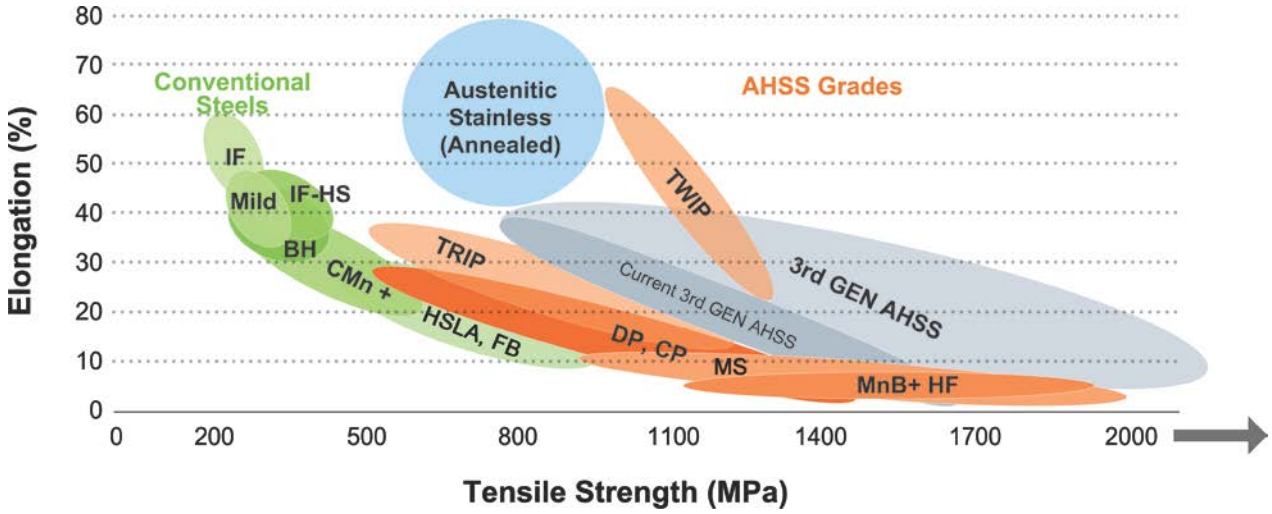
The Future of Advanced High-Strength Steel

As fuel economy and performance standards increase, so does the need for new and improved materials. While there are a number of competing low-density materials for automotive applications, none offer the complete package – strength, lightweighting, affordability and sustainability – of steel. The global steel industry is meeting this need through the development of new advanced high-strength steel (AHSS) grades, whose unique metallurgical properties and manufacturability enable the automotive industry to affordably meet increasingly stringent requirements.

- There are more than 200 grades of steel, ranging in strength levels of 200 MegaPascals (MPa) to more than 1900 MPa tensile, versus just 19 grades of aluminum. For the same strength level, steel is more formable than aluminum.
- Steel offers the largest range of strength levels compared to any other monolithic materials (150 MPa to more than 1500 MPa) giving it significant advantages in product applications and in manufacturing, especially joining.
- Third generation AHSS grades are being developed to create higher strength and formability choices for carmakers.
- The steel and automotive industries are researching new applications for steel, defining local material properties for specific manufacturing strain paths and generating fatigue and corrosion resistance data to improve modeling predictions, vehicle performance and cost.
- AHSS is used in a number of new applications, and the results are showing improved vehicle performance, fuel efficiency, affordability, durability and quality.
- In the past 10 years, new steel innovations have proven to reduce component mass by nearly 25 percent and more recent studies have increased the mass savings to 29 percent versus traditional mild steel benchmarks.
- The industry is working to improve processing methods for AHSS applications with the development of unique, high-tech approaches to manufacturing parts and assemblies from new steel grades.
- Stamping and tooling operations are being examined, as well as joining strategies and models for formability, to enable the easy transition of new grades to existing stamping, joining and assembly processes.

Steel Strength Ductility Diagram

- First-generation AHSS include dual phase (DP), ferritic-bainitic (FB), complex phase (CP), martensitic (MS), transformation-induced plasticity (TRIP) and hot-formed (HF). They offer improved formability over a wide range of tensile strengths compared to conventional high-strength steels.
- Second-generation AHSS are austenitic and include twinning-induced plasticity (TWIP). They are extremely strong and formable and can be used to provide extraordinary mass reduction for difficult-to-form parts.
- Third-generation AHSS are under development with some grades currently being introduced commercially. These grades will mainly be multi-phased steels with similar strength, but enhanced formability compared to first generation AHSS.



The steel strength ductility diagram chart shows the continued evolution of new and third generation advanced high-strength steels.

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