

宝钢GA汽车板

热镀锌铁合金镀层钢板

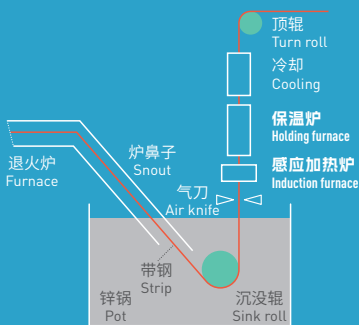
BAOSTEEL GA AUTOMOTIVE SHEET

HOT DIP GALVANNEALED STEEL SHEETS

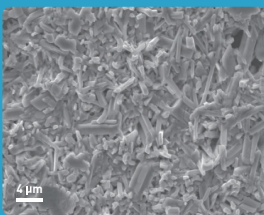


GA汽车板,即汽车用热镀锌铁合金镀层钢板,其制备工艺是在带钢经连续热浸镀锌后立即施以精确控制的快速合金化退火处理,通过高温扩散使钢基体中的铁与镀锌层发生合金化反应,从而将镀锌层完全转化为锌铁合金(Fe含量约7-14wt%)。锌铁合金镀层不仅保留了纯锌镀层对钢基体的电化学保护作用,还提高了镀层焊接性能和涂装性能,同时兼具优良的胶粘性和加工成形性,其综合性能更佳。

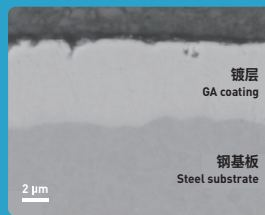
GA Automotive Sheet, or hot dip galvanized steel sheet for automotive applications, is produced by subjecting the steel strip to a precisely controlled rapid alloying heat treatment immediately after continuous hot-dip galvanizing. This process promotes high-temperature diffusion, inducing an alloying reaction between the iron from steel substrate and the zinc coating, thereby fully transforming the layer of pure zinc into zinc-iron alloy (with Fe content of approximately 7 to 14 wt%). The zinc-iron alloy coating offers superior overall performance by retaining the cathodic protection characteristic as pure zinc coatings, but also enhancing weldability and paintability while exhibiting good adhesive properties and formability.



GA钢板合金化退火处理示意图
Schematic of the alloying treatment after galvanizing for GA sheet



GA镀层典型表面微观形貌
Typical microscopic view of surface morphology of GA coating



GA镀层典型截面微观形貌
Typical microscopic view of cross-section of GA coating

GA汽车板的优势

Advantages of GA coating

GA汽车板,具有优良的加工、焊接、涂装和耐蚀性能,能满足高品质汽车板车身零件加工使用,尤其适合于钝化(2C1B 涂装)等环保新装备、新工艺的应用,可广泛用于汽车车身浅/深冲零件、外板覆盖件、安全结构件(包括电池包壳体及结构支撑件)等各种高中低要求的零部件。具备好用、好看、好强(好安全)、好环保、好低碳的特点。

GA automotive sheet exhibits excellent formability, weldability, paintability, and corrosion resistance making it suitable for producing high quality automotive body components, and particularly well suited for environmental friendly painting processes featured by Zirconium-based pretreatment (e.g., 2C1B painting process). This material can be widely used for normal or deep drawing parts, outer panels, safety structural components (including battery pack house and structural supports), etc. It features advantages of better formability, more aesthetically pleasing appearance, higher strength (thus better safety), more eco-friendly, and more decarbonation.



加工性能优良: GA(锌铁合金,以下同)镀层硬度高,比GI(纯锌,以下同)镀层更耐摩擦;

Good formability: The GA(zinc-iron alloy, hereinafter the same) coating possesses higher hardness and offers better wear resistance than GI(pure zinc, hereinafter the same) coating.



焊接性能优异: 相比较GI镀层, GA镀层可焊电流范围更宽,焊接电流更低,电极寿命更长;

Excellent weldability: Compared with GI coating, GA coating has a wider welding lobe, lower welding current, and better electrode endurance for resistance spot welding.



胶粘性好: 锌铁合金镀层与胶粘剂的机械锚固性好,化学键合力强。

Strong adhesive bonding: The zinc-iron alloy coating ensures effective mechanical anchoring and strong chemical bonding with adhesives.



涂装性能优异: 镀层表面易磷化和钝化成膜,涂漆附着力好;

Superior paintability: The micro-rough coating surface facilitates easy phosphating and zirconium-based pretreatment, resulting in excellent paint adhesion.








耐蚀性好: 对钢基体提供持久的电化学保护,涂装后耐蚀性更佳;

Good corrosion resistance: Provides durable cathodic protection to the steel substrate, with further enhanced corrosion resistance after painting.

宝钢GA汽车版品种及规格

Varieties and specifications of Baosteel GA automotive sheets

	厚度规格 Thickness	0.45~3.2mm
	强度级别 Strength level	目前最高抗拉强度1500MPa At present max.tensile strength 1500 MPa
	宽度规格 Width	800~2080mm
	可供品种 Available varieties	AK, C-Mn, IF, HS-IF, BH, HSLA, DP, QP, DH, CP
	生产能力 Production capacity	

宝山基地3条热镀锌机组 (其中2条GA专用机组)
Baoshan Base 3 CGL Lines (Incl. 2 GA dedicated Lines)

东山基地2条热镀锌机组
Dongshan Base 2 CGL Lines

青山基地1条热镀锌机组
Qingshan 1 CGL Line

最大共 **180**万吨/年
Total MAX 1.8 MMt/Y

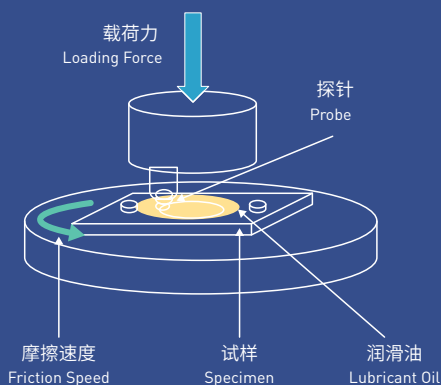
此外, 宝山、东山基地各有一条热镀锌机组, 具备GA切换生产能力, 可短期内实现GA生产切换, 生产能力合计45万吨/年
Furthermore, Baoshan and Dongshan Bases are each equipped with one CGL line that can switch to GA production, and these two lines can switch to GA production with a capacity of 0.45 MMt/Y in a short period.

冲压友好

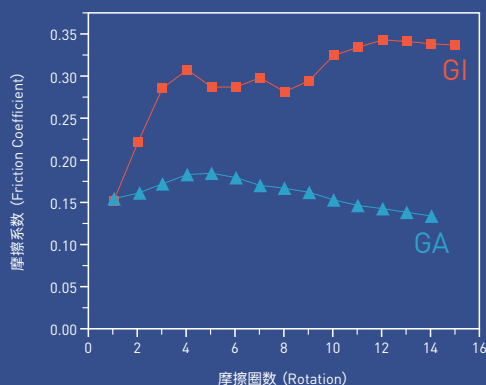
Good formability

随着连续冲压时间增加, 镀锌钢板表面摩擦系数发生变化, 造成摩擦力增大和镀层磨损。GA镀层较GI镀层表面硬度更高, 摩擦系数更低且稳定, 从而降低冲压开裂风险和镀层磨损频率。

As continuous stamping time increases, the surface friction coefficient of galvanized steel sheets changes, leading to increased frictional force and coating abrasion. The GA coating exhibits higher hardness, resulting in a lower and more stable friction coefficient compared to the GI coating, and thereby reducing the risk of stamping cracking and the occurrence of coating abrasion.



镀层表面球磨擦系数试验示意图
Schematics of ball-on-disk friction coefficient testing method



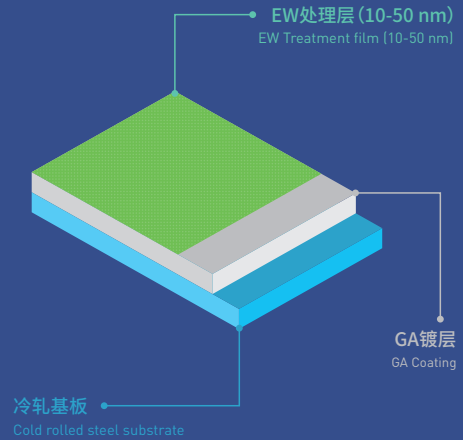
球摩擦系数随摩擦圈数的变化规律
Evolution of friction coefficient measured by ball-on-disk test method with number of rotation

环保良加工EW表面处理产品

Environmental friendly EW (Easy Workability) surface functional products

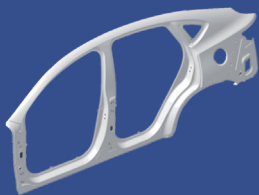
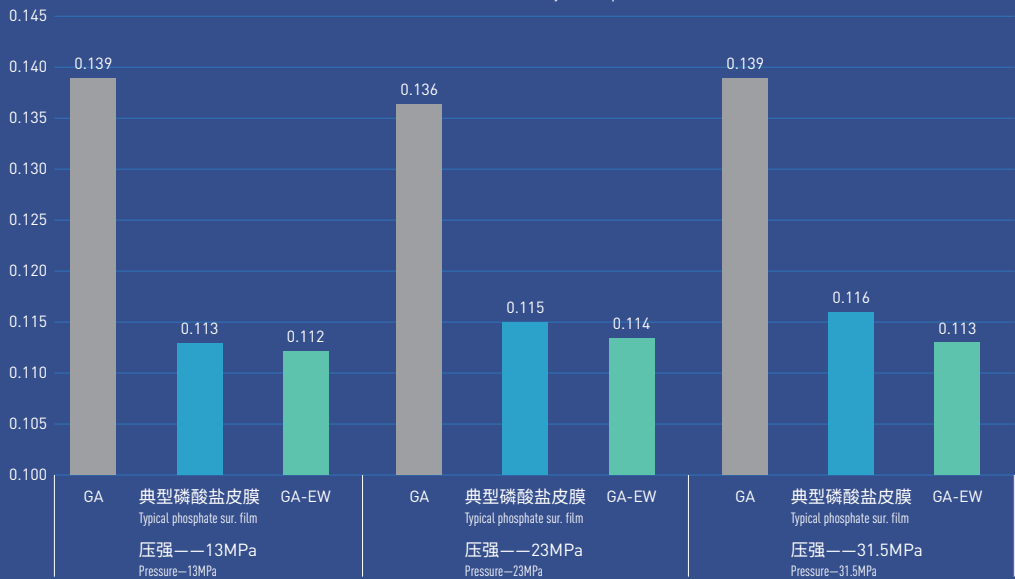
热镀锌铁合金环保良加工EW (Easy Workability) 表面产品, 通过在镀层表面构建复合纳米结构, 实现表面摩擦润滑、胶粘连接和锆化成膜的多功能集成。该产品可有效支撑主机厂在极致冲压效率, 稳定连接功能和绿色环保涂装工艺应用过程中对表面综合功能的需求。

The hot dip zinc-iron alloy "Easy Workability" (EW) surface product integrates multiple functions - surface friction lubrication, adhesive joining, and zirconium-based film formation - by engineering a composite nano-structure on the galvanized surface. It reliably meets OEM demands for extreme stamping speed, stable joining performance, and environmentally friendly coating processes, all through one synergistic surface.



平板摩擦2-5次摩擦系数均值 (65°C)

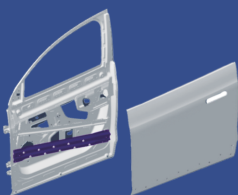
Mean value of friction coefficient after 2-5 cycles of plate friction test (65°C)



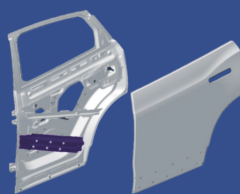
侧围外板
Side pannel outer



发罩内外板
Hood inner and outer



前门外板和内板
Front door inner and outer



后门内板和外板
Rear door inner outer



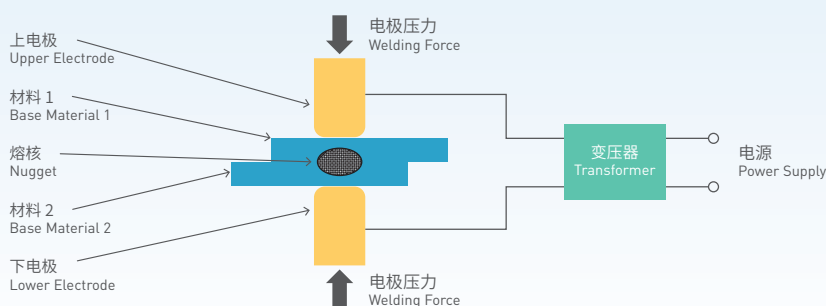
翼子板
Fender

电阻点焊是白车身焊装生产中使用最广泛的焊接方法。可焊电流区间和电极寿命是评价材料电阻点焊可焊性的两项关键指标。相同工况下，GA镀层产品比GI镀层产品的电阻点焊可焊性更优。

Resistance spot welding is the most commonly used welding method in the production of body in white. The weld lobe and electrode endurance are two key indicators for evaluating the resistance spot weldability of base material. Under the same working conditions, GA coated products have better resistance spot weldability than GI coated products.

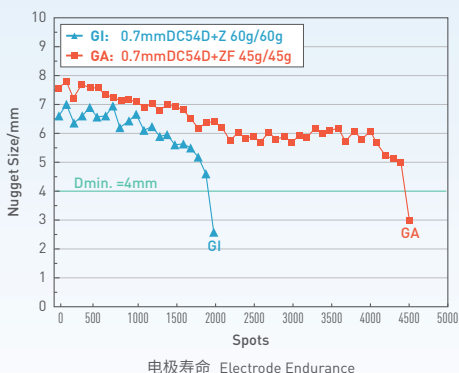
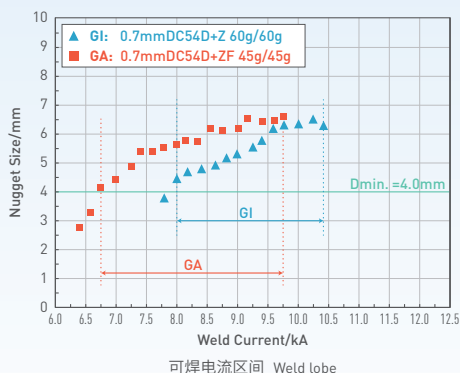
电阻点焊原理示意图。基于焦耳定律，待焊材料在电极压力作用下被充分压实，阻焊变压器对焊接区施加强大的焊接电流，使材料局部熔化形成熔核，断电后熔核凝固形成焊点，实现材料连接。

Schematic diagram of resistance spot welding principle. Based on Joule's law, the material to be welded is fully compacted under welding force. The transformer applies a large welding current to the welding area, causing the material to melt locally and form a nugget. After the power is turned off, the nugget solidifies to form a welding spot, achieving material connection.



可焊电流区间的上限：发生焊接飞溅时对应的最小焊接电流；可焊电流范围的下限：熔核直径等于 $4t^{1/2}$ (t为板厚)时对应的焊接电流。电极寿命：一副新电极在不修磨、焊接参数不调整的条件下，可以连续焊接合格焊点的次数，焊接电流为可焊区间上限减200A。

Upper limit of weld lobe: Minimum welding current corresponding to expulsion. Lower limit of weld lobe: The welding current corresponding to the nugget diameter of $4t^{1/2}$ (where t is the plate thickness). Electrode endurance: The number of times for a pair of new electrodes that can continuously weld qualified spots without dressing or adjusting welding parameters (welding current is 200A less than the upper limit of the weld lobe).

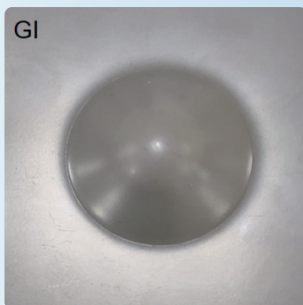
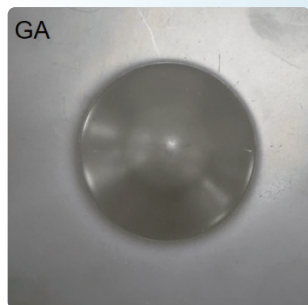


涂装与耐腐蚀友好

在电泳涂装领域，GA与GI镀层钢板均被誉为具备“良好的附着性能”。然而，其背后的机理和最终呈现的防护效果却存在显著差异。GI材料提供了可靠的基础附着力，而GA材料则通过其独特的镀层表面微观结构，实现了卓越的漆膜“机械锁合”附着力，从而在涂装后的耐腐蚀寿命上更胜一筹。

Excellent paintability and corrosion resistance

In the field of electrocoating, both GA and GI coated steel sheets are regarded as having “good adhesion performance”. However, the underlying mechanisms and the resulting protective performance differ significantly. GI materials provide reliable intrinsic adhesion at the coating-substrate interface, whereas GA materials, owing to the unique microstructural characteristics of their coating surface, enable superior “mechanical interlocking” of the paint film. As a result, GA-coated steels generally exhibit a longer corrosion protection lifetime after painting.



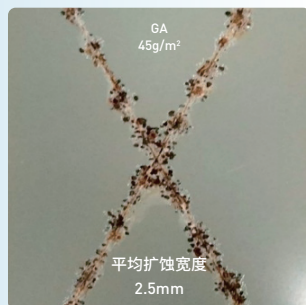
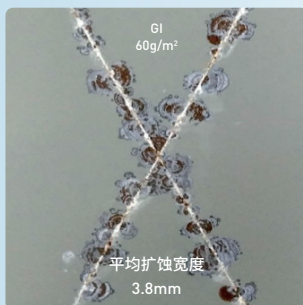
涂装后7mm杯突附着性测试，漆膜无剥落
(电泳漆膜厚度20微米)

After painting, the 7 mm cupping-adhesion test shows no paint-film delamination (electrodeposition coating thickness: 20 μm)



涂装后耐蚀性试验，参照标准PV1210-42循环，磷化+电泳20微米

Post-paint corrosion resistance test, conducted in accordance with PV1210-42 cyclic test, with phosphating + electrocoating (20 μm)



胶接友好

GA镀层表面微观形貌粗糙，有利于胶粘剂的机械锚固，并且锌铁合金与胶粘剂的化学键合能力强。GA汽车板与常用点焊胶和减震胶的适用性优异。

Excellent adhesive bonding

The surface of the GA coating exhibits a rough micro-topography, which provides the mechanical interlocking for adhesives. Additionally, the zinc-iron alloy possesses strong chemical bonding with adhesives. GA automotive sheet demonstrates excellent compatibility with commonly used spot-weld adhesives and damping adhesives.



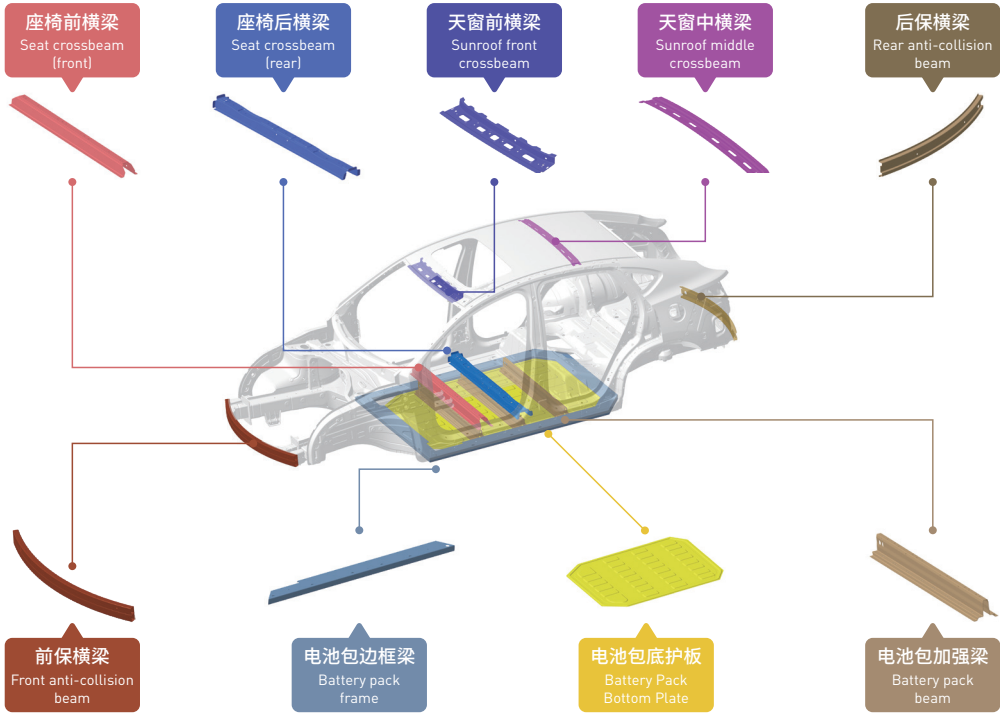
减震胶适用性评价结果
Results of evaluation of compatibility
with damping adhesive



点焊胶适用性评价结果
Results of evaluation of compatibility
with spot-welding adhesive

宝钢GA吉帕钢®为门槛梁、地板纵梁、座椅横梁、天窗加强梁、前后防撞梁、车门防撞梁等关键安全部件提供理想解决方案，并拓展至电池包边框梁、加强梁、底护板等小总成部件，满足汽车行业对轻量化、高安全、低碳化的更高需求。

Baosteel GA X-GPa® Steel provides Side sill reinforcement, floor longitudinal beams, seat crossbeams, sunroof reinforcement beams, front and rear anti-collision beams, door inner anti-collision beams, and battery pack frames and beams, bottom plate for NEV, which meet the comprehensive requirements of the automotive industry for safety, lightweight, and decarbonation.



卓越性能

Excellent performance

兼具超高强度和优良成形性，突破传统高强度钢的应用局限
It has both ultra-high strength and excellent formability, breaking through the application limit of traditional high-strength steel.

极致精度

Ultimate precision

最高不平整度交货，助力冷成形零件超高尺寸精度需求
Delivery with maximum flatness precision, supporting the demand for ultra-high dimensional accuracy of cold forming parts.

显著减重

Significant lightweight

超高强度带来更优的轻量化潜力，助力整车减重降耗
Ultra-high strength results in greater lightweight potential, contributing to more lightweighting and energy consumption reduction of the vehicle.

长效防护

Extreme corrosion resistance

GA 镀层确保优异的耐腐蚀性能，延长关键部件服役寿命
The GA coating ensures excellent corrosion resistance, effectively extending the service life of key components.

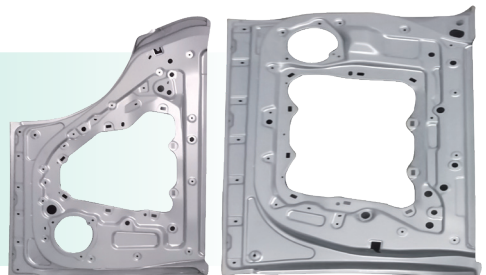
宝钢低碳排放热镀锌汽车板典型应用

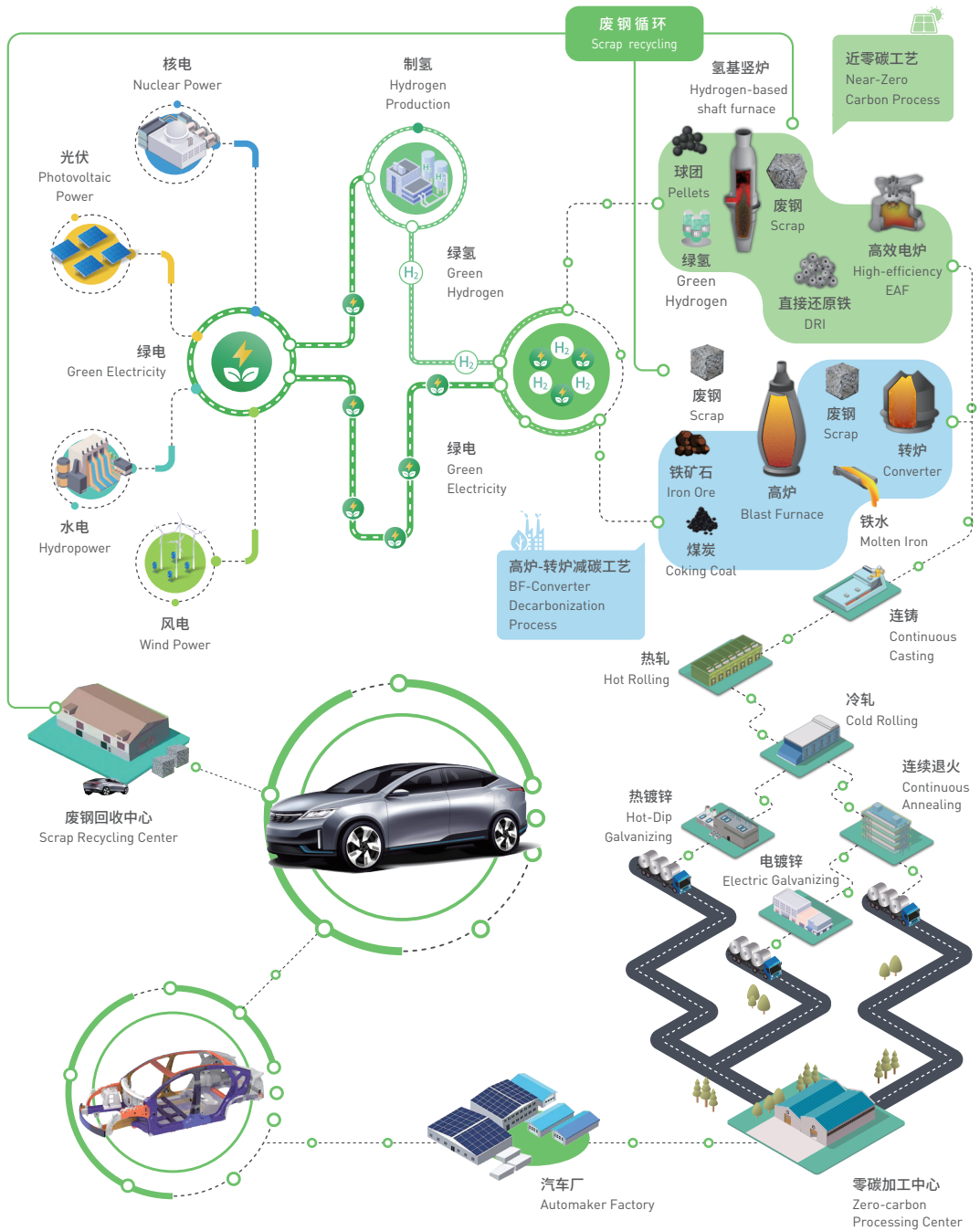
Typical application of Baosteel low-carbon emission hot dip galvanized automotive sheet



宝钢股份联合某新能源车企合作试制低碳排放前后门内板零件
Baosteel and users jointly launched low-carbon emission door inner panel parts

碳排放 ↓ 30%
Carbon emissions ↓ 30%





宝钢汽车板SMARTeX

携手行业伙伴

共同推动车身技术升级

为汽车产业高质量发展提供创新材料解决方案

Baosteel SMARTeX

Joins hands with partners

Promotes car body technology upgrades

Provides innovative material solutions for the global automotive industry



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