

Baosteel Automotive Steel Sheet EVI

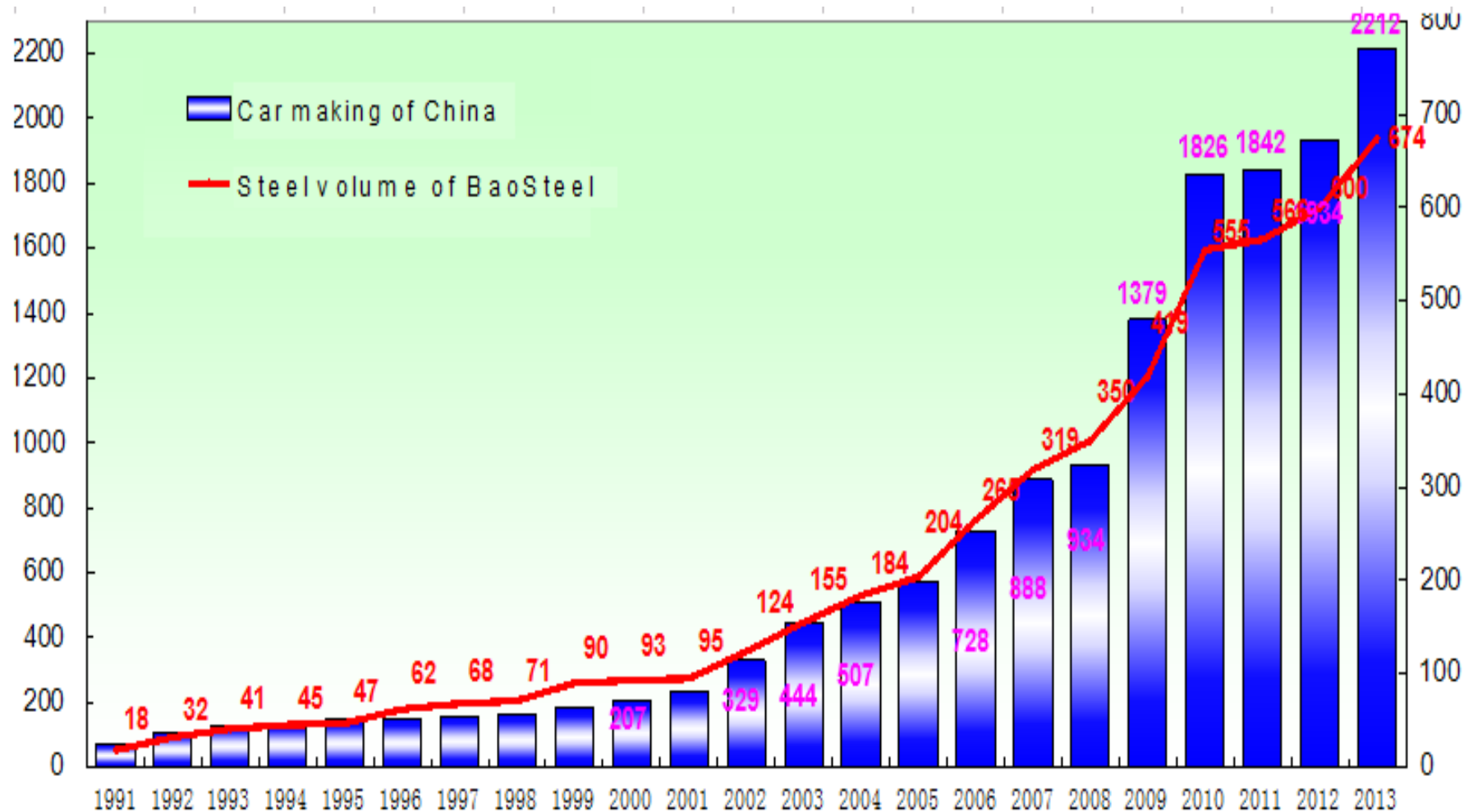
Baoshan Iron & Steel Co., Ltd.
Automotive Steel Sheet Sales Department

June, 2014

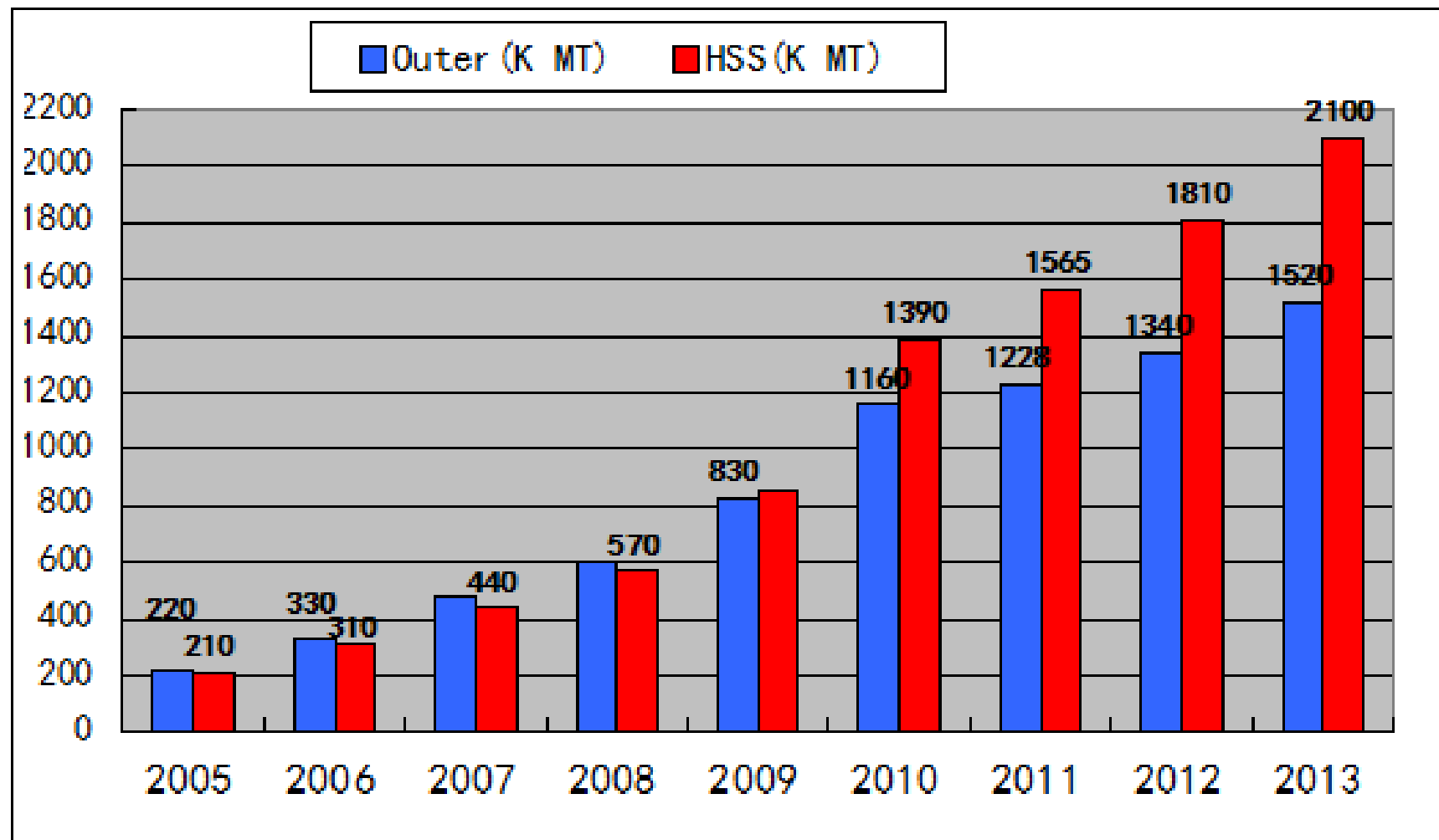
Contents

- 1. Baosteel Auto Steel Sheet Sales Volume**
- 2. Baosteel Auto Steel Sheet EVI**
- 3. Implement Models and Practical Cases**
- 4. Future Development of Baosteel EVI**

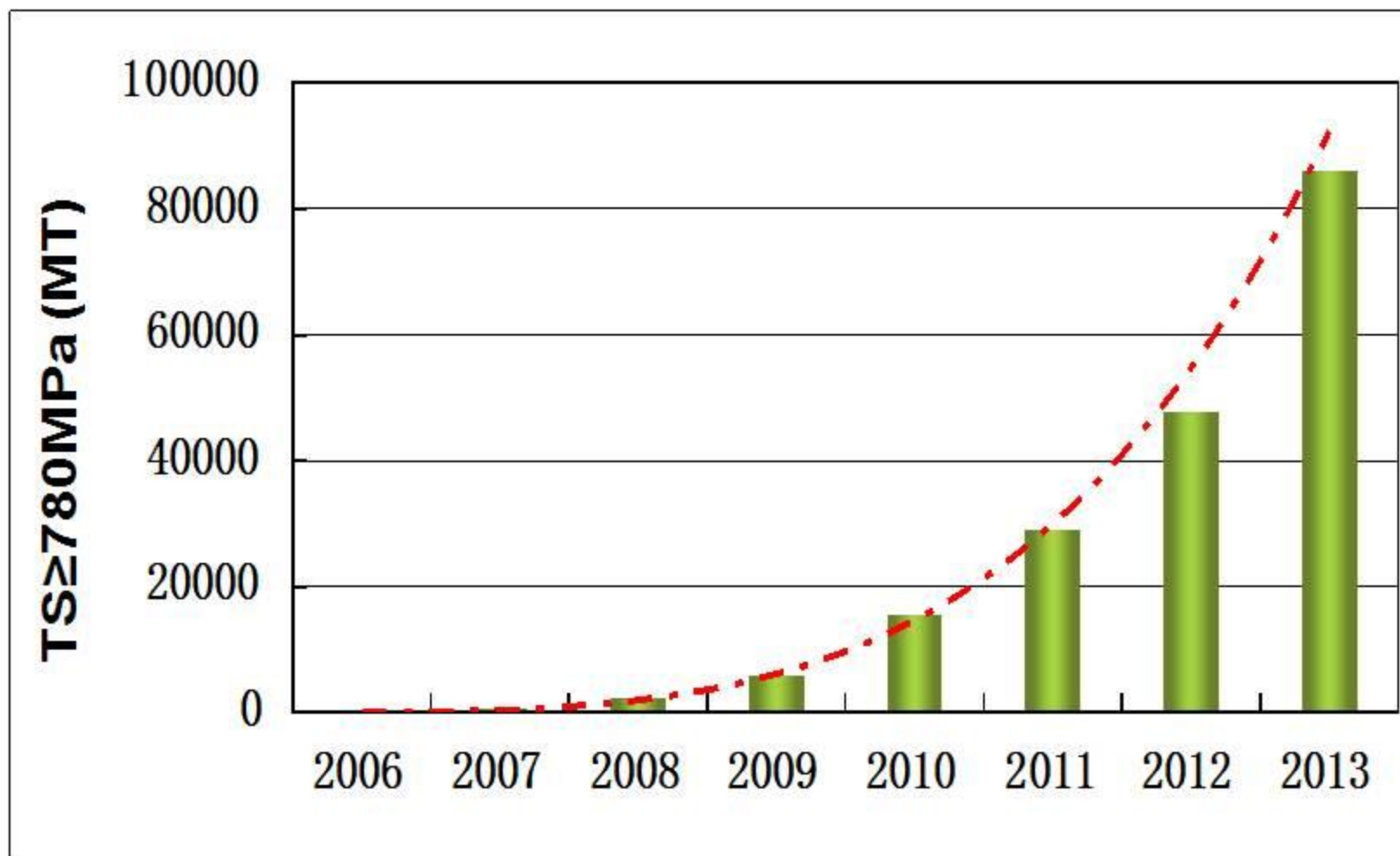
Auto Steel Sheet Sales Volume



HSS & Outer Panel Sales Volume



UHSS Sales Volume



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What's Baosteel EVI



EVI (Early Vendor Involvement)



Baosteel offers technical support

from concept design to mass-production stage

- 1 Material selecting in auto concept design, simultaneous engineering in components development, and quality/cost control in production
- 2 Tooling design and pre- and post-production evaluation to ensure the best matching between the tooling and shee
- 3 Optimization of steel application for auto in terms of cost and performance purposes
- 4 New materials, new technologies recommended applications and enhance the competitiveness of automotive products

Why Baosteel Carry Out EVI

Through EVI cooperation with the clients, We can continuous Improve the new car's quality & competitiveness, promote the lightweighting technology progress.

Automaker

1. Body Light-weighting
2. Safety, reliability
3. Better design
4. Lower cost

Baosteel

1. Lightweight materials
2. Applicable technologies
3. Design optimization
4. Technical cost reduction

EVI Collaboration

Face together to the challenges of developing automotive industry

Environment

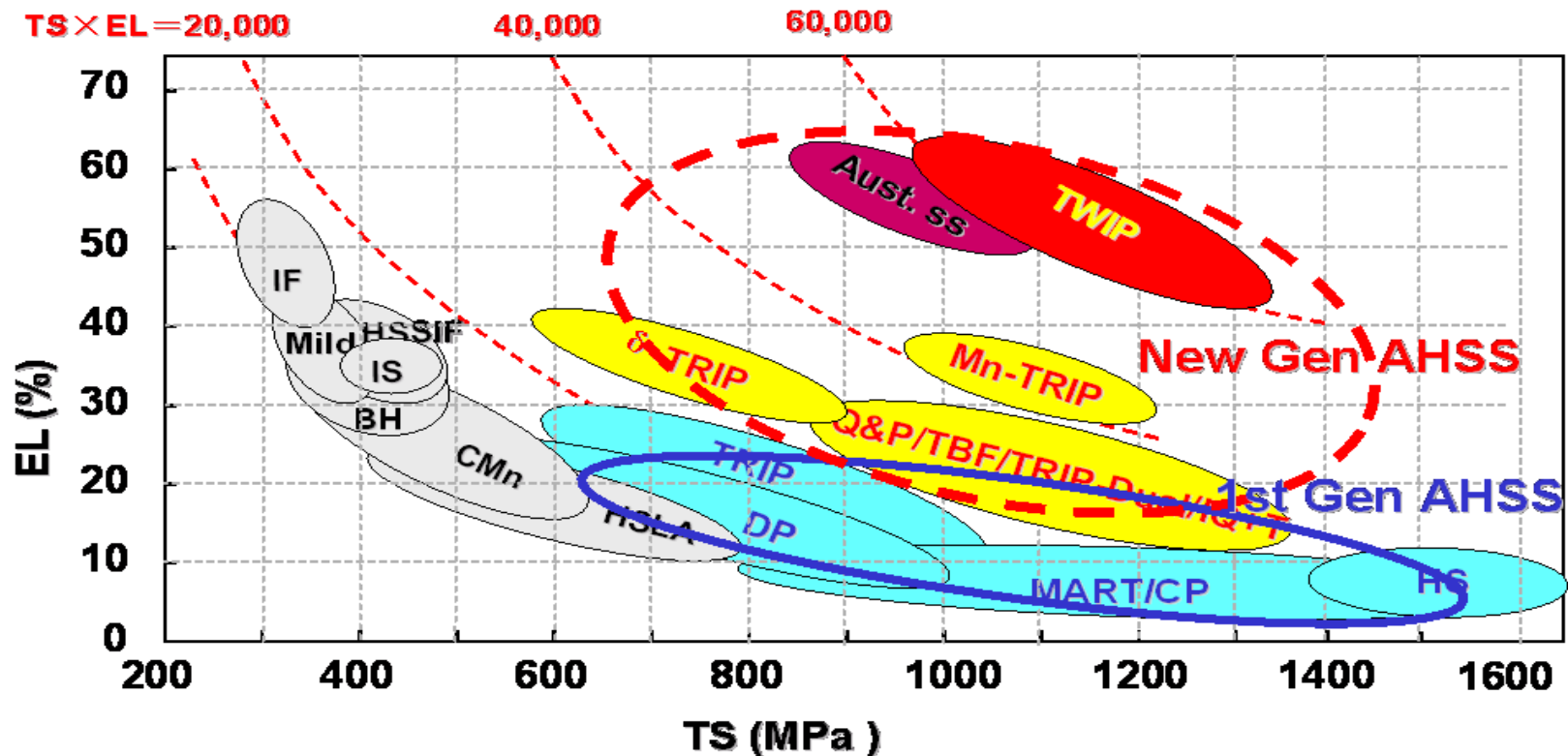
Fuel and Safety

Market competition

What Can Baosteel Do In EVI

Full range of products

Baosteel auto steel sheet can provide large range of products, having rich experience in research, manufacturing & application support.



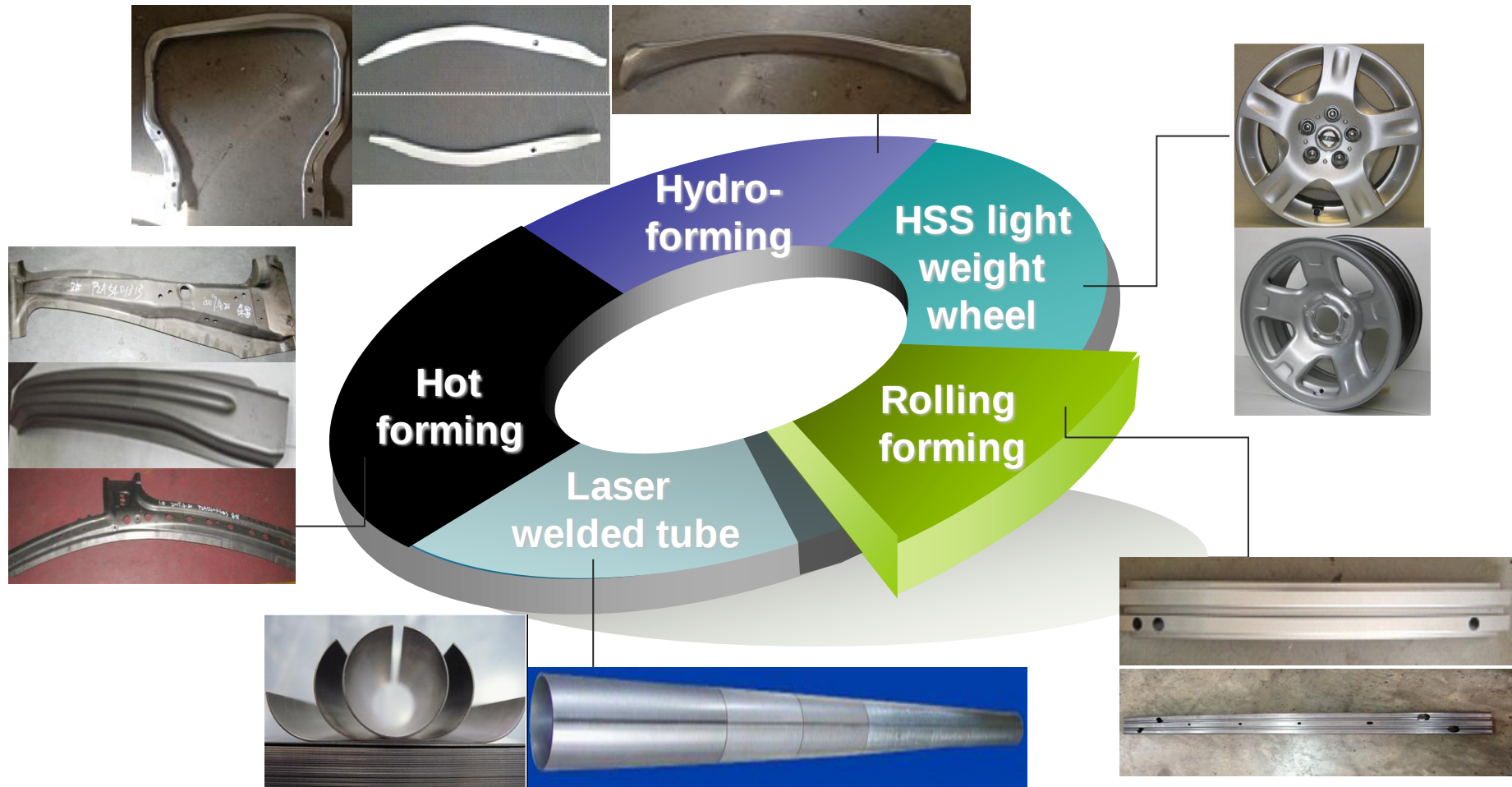
Category include HR, CR, GI, GA&EG, delivery according to various standard.

What Can Baosteel Do In EVI



Advanced car parts and design support

Baosteel can provide advanced process technology promotion, possibility & performance estimation, simultaneous development support & parts supply.



Comprehensive application support

Forming

- Mechanical properties
- Friction coefficient
- High strain test
- Stamping formability
- Other type of formability
- Springback control

Welding

- Weldability evaluation
- Joint strength evaluation
- Welding defect improvement
- Study on the welding of HSS & technical support

Anticorrosive & Auto painting

- Coating defect analysis
- Coating quality optimization
- Anticorrosive effect evaluation
- Application research on new auto painting process

Experimental Platform of UHSS stamping

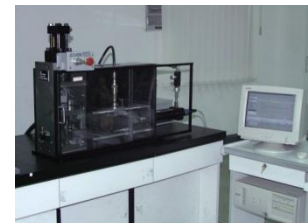
850T UHSS Press forming machine

UHSS V-bending machine

HAT die based on MTS

Springback test die based on MTS

Digital springback measuring system



What Can Baosteel Do In EVI



Innovative research and development ability

Baosteel established high-level innovative research platforms with cooperative partners depending on the State Key Lab of Autosteel

● Industry platform

❖ Steel sponsor in "China Auto Lightweight Alliance"

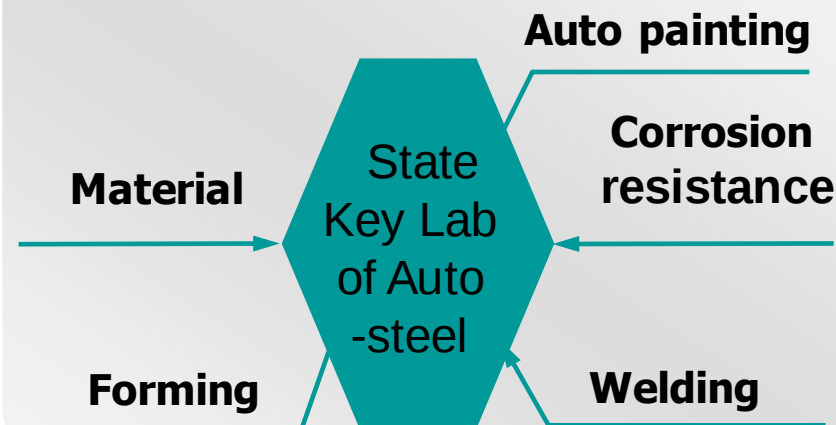


● Enterprise platform

- ❖ Technical cooperation
- ❖ Technical exchange & training
- ❖ United technologies research & application development

6 Baosteel-Automaker united research labs have been established in China

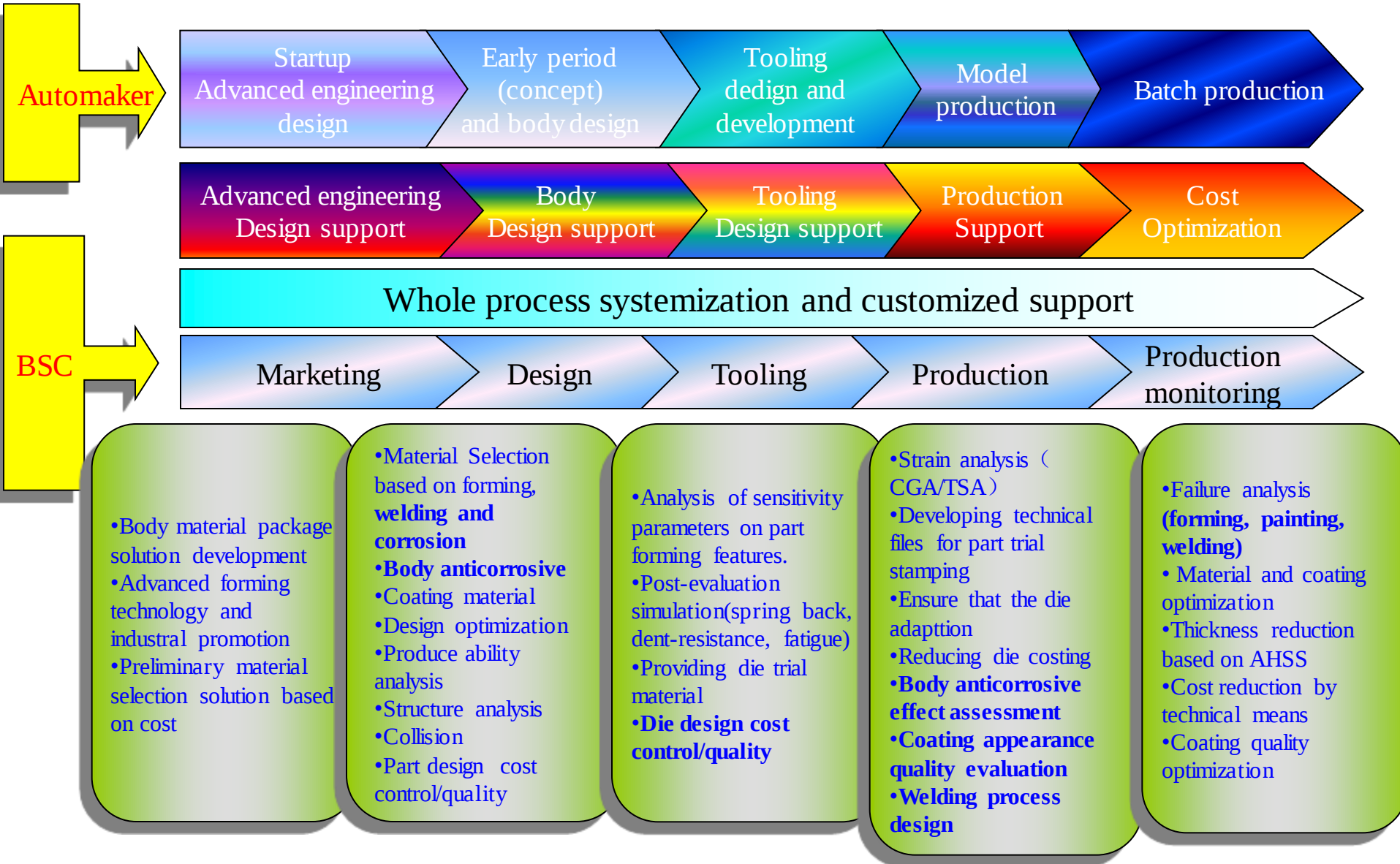
● The State platform



Baosteel EVI Roadmap



Baosteel EVI technical support mode in the life-cycle



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Three types of cooperation models were established to effectively meet the improved requirements of our customers on the car weight reduction, material utilization and corrosion resistance etc.

1. BIW EVI

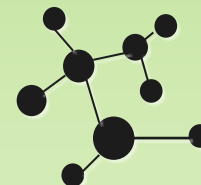
Establish the cooperation team. Baosteel **fully involved** and participated in **the vehicle design process (bending stiffness, twisting stiffness, NVH, crash performance, etc.)**. Auto sheet material selection and other aspects to ensure the lightweight vehicle or cost/material utilization will be conducted.

2. PARTS EVI

Aimed at **critical assembly parts and complex shaped parts**, Baosteel uses its materials and technology advantages to **participate in material selection, structural design, process design and safety analysis** to ensure the requirements of safety and cost .

3. DIE EVI

Provide free stamping die inspection and failure analysis to ensure the stability of mass production with the highest efficiency and lowest cost.



BIW EVI case : Cost-optimal models under constraints of Safety and Weight

2

Given purchasing cost targets of body steel in the premise of safety and weight

3

Make technology roadmap

4

Work style: Service lived
Collaborative development,
Concurrent engineering

1

Benchmarking cars and subdivision
Market Cost

材料技术

高强减薄
牌号优化
选材优化

工艺技术

工序优化
坯料优化
先进工艺

设计技术

稳健设计
敏感优化
成形分析

一揽子技术

先进零件
方案解决
协同开发

高强钢与使用技术
车身性能分析技术
成形选材匹配技术

现场工序技术
成形优化技术
先进制造技术

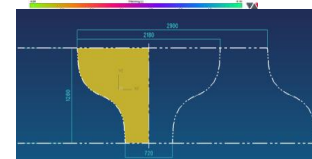
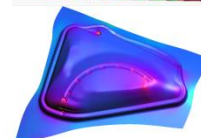
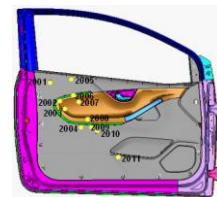
精益成形技术
零件CAD技术
成形CAE技术

零件开发技术
方案储备技术
同步开发技术

●Thinning and structural optimization based on NVH analysis of strength stiffness collision.

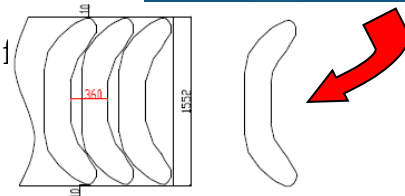
●To achieve thinning and reduced costs by advanced forming technology

●Optimized design, improved material utilization



5

Cost estimates of the whole process



6

Win-win

- Body weight:
Reduced by 11%
- Material utilization:
Enhance 2.7%
- Cost of body steel :
Reduced by 25%

加工类型	零件重量 (kg)	综合材料利用率	投料重量	材料成本 (元/件)	模具摊销成本 (元/件)	落料成本	成型、冲压、包装成本未改变	合计 (元/件)
现有：单体落料	1.94	30.89%	6.280	40.60	0.58	2.17		43.35
改进后：级进落料	1.94	36.86%	5.263	34.91	1.05	2.11		38.06
差异	0	5.97%	-1.0171917	-5.70	0.47	-0.06		-5.28

Key technologies

Improving material utilization

Material optimization

Grades merge
Coating selection
.....

Addendum Optimization

Two parts per mold
Profiled blanking
.....

Blanking optimization

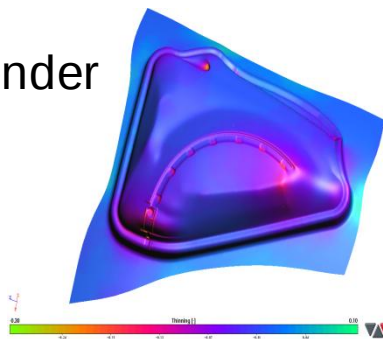
Layout \ Process Optimization
.....

Advanced Technology Applications

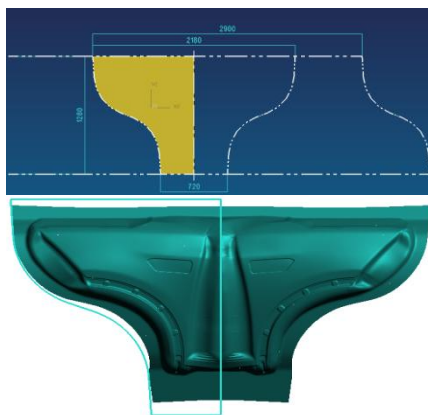
Hot Stamping Design
Rolling Design
.....

Original design

Fender



Baosteel:
Two parts per mold



Original design:
One part per die;
Blank: Keystone, Pendulum Shear;
Material utilization: 31%.

After optimization:
Two parts per die;
Blank: Profiled, Blanking;
Material utilization: 52%.

Material utilization was improved by 21%

To use 1.4mm HC980/1180MS roll forming to replace 2.0mm B410LA stamping, Baosteel offers package technical solutions from **the part design, welding design to manufacturing and vehicle assembly.**

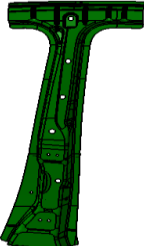
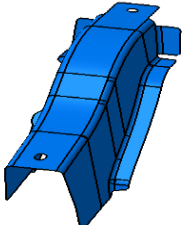
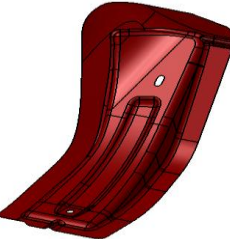
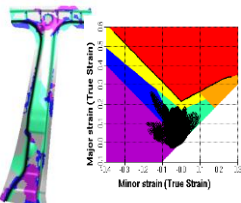
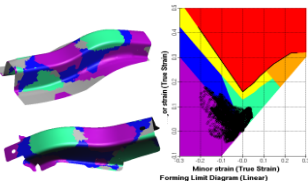
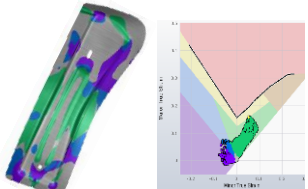


Three metal extrusion profiles are shown, illustrating different cross-sectional shapes. The top profile is a simple rectangular shape. The middle profile has a more complex shape with a central slot. The bottom profile is a T-shaped extrusion.



Parts EVI case 2: Design support of replacing PHS parts with Q&P

Baosteel is working with an Italy well-known design company in replacing PHS parts with Q&P. After providing Implementation technical reports including formability analysis, forming process simulation& problem solving, both parties choose REINF-CTR FLOOR as the first prototype , using Q&P1180.

Part Name	REINF-CTR PLR	MBR-SIDE. RR. FR PART	REINF-CTR FLOOR
Part Geometry			
Original Material	22MnB5, 1.6 mm	22MnB5, 1.5 mm	22MnB5, 1.2 mm
Substitute Material	Q&P980, 1.6 mm	Q&P980, 1.5 mm	Q&P980, 1.2 mm
BAOSTEEL CAE			



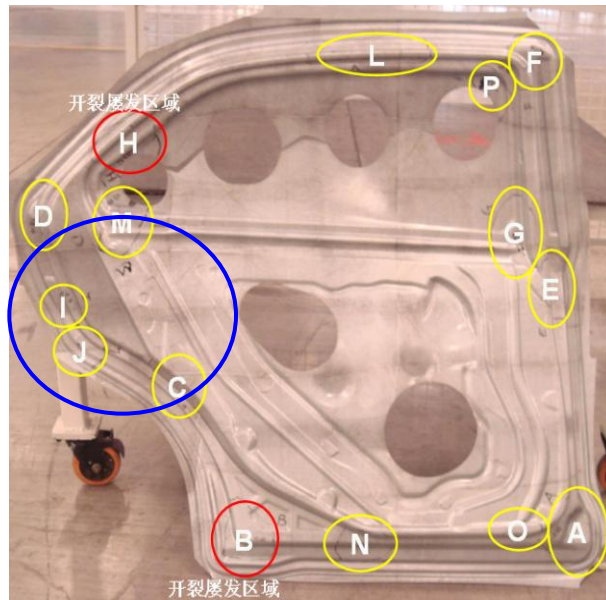
More works upcoming

- Steel grade updating
- Formability analysis
- Cost evaluation
- Process simulation
- Process problem solving
- Collision analysis

Die EVI case : Die support of a door inner panel

Molds of a car's rear door inner panel were made in Germany. Serious cracking and wrinkling occurred when debugging, long time no solved.

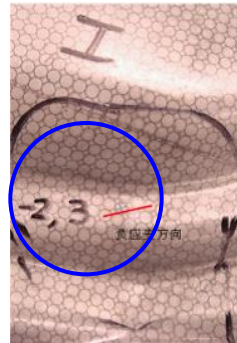
Baosteel carried out the mesh analysis, pointing out there were unreasonable states of strain distribution in each region, and making a subsequent improvement measures, solving the problem eventually.



Parts Schematic

Red : Crack-prone areas

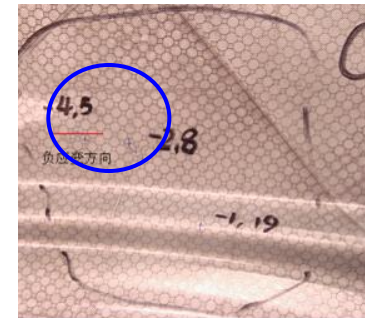
Blue: Wrinkle-prone areas



Strian state: shallow drawing

Wrinkling cause: Minor strain is compressed

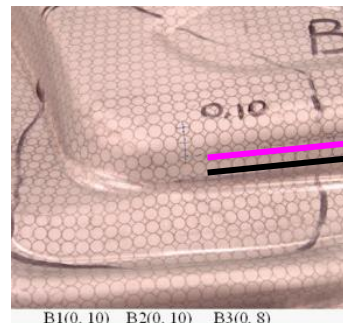
Proposed adjustments: Adjust local BHF



Strian state: Plane strain -> shallow drawing

Wrinkling cause: large Strain gradient

Proposed adjustments: Improve the material flow



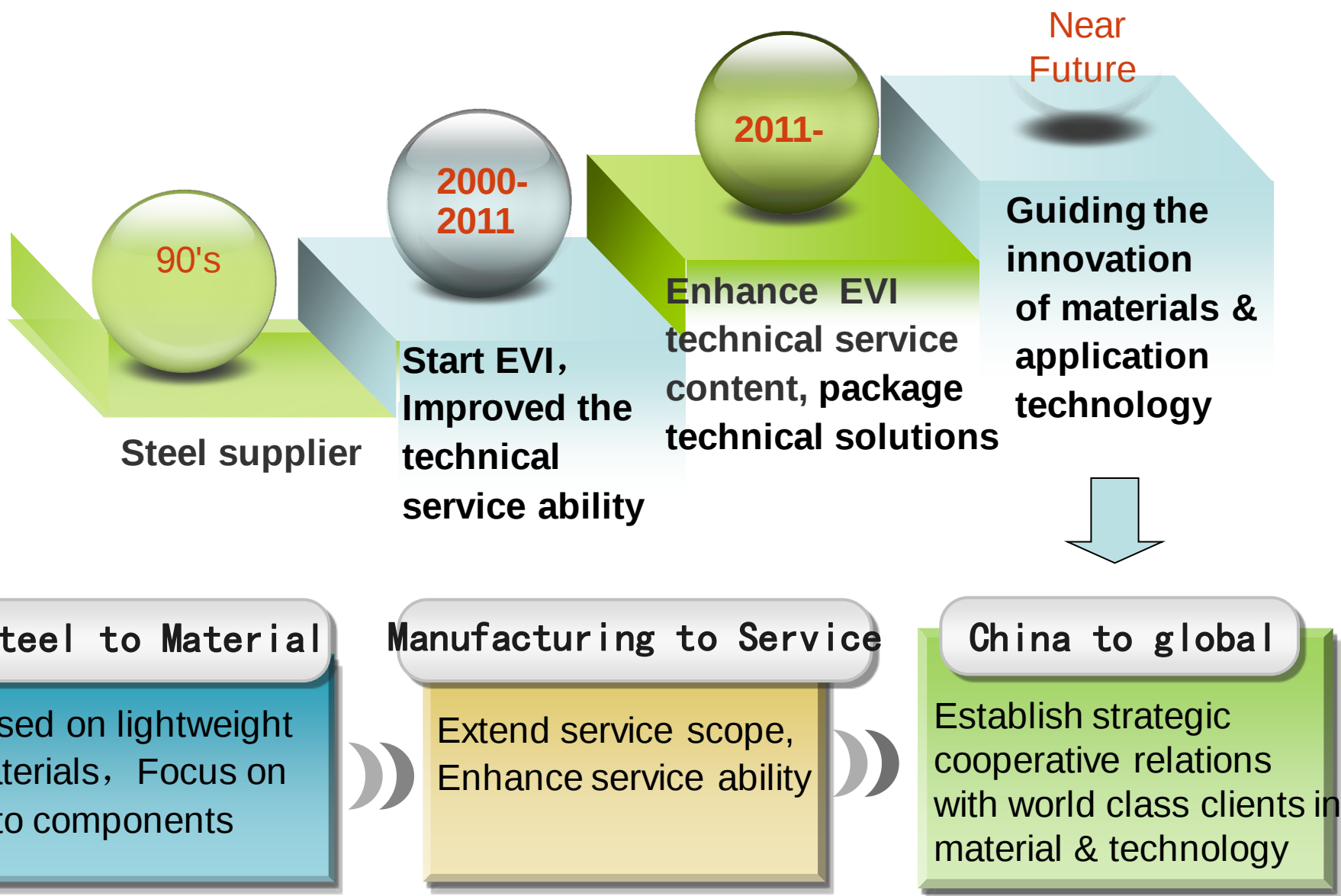
Strain state: Plane strain

Crack cause: Sliding touch line

Proposed adjustments: Adjust the blank position

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Thank you !

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