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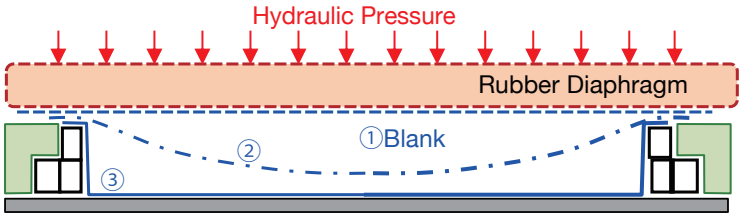
Battery case concept
(Frame and tray integrated structure)

Benefits

- Improve productivity by omitting the tray and frame joining process.
- Expansion of space for batteries.
- Others (reduction of mold cost, improvement of EA performance & rigidity, addition of cooling function, etc.)

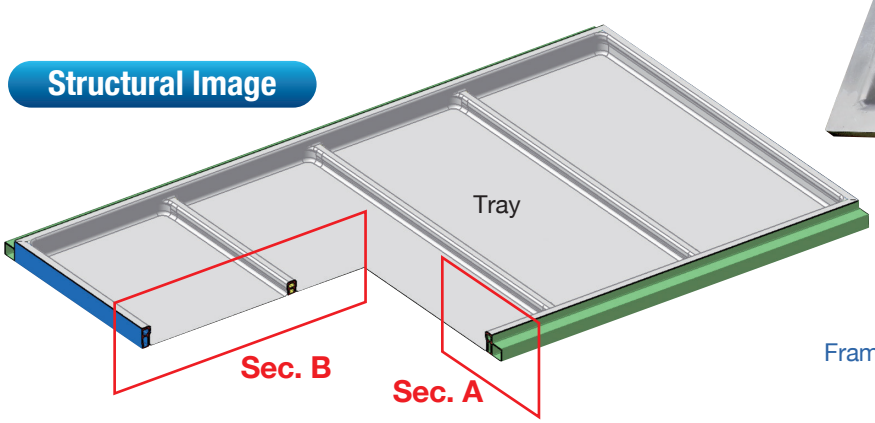
Construction

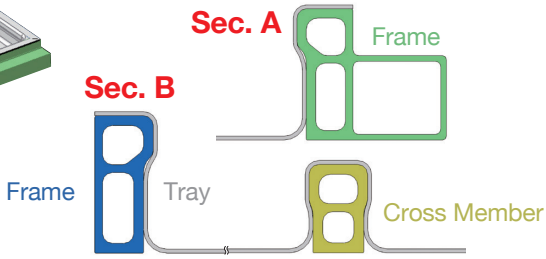
- Simultaneously processing of battery tray press forming and frame integration.
- Complicated shape (small radius, negative angle) can be formed by hydraulic pressure through rubber diaphragm.



Sample

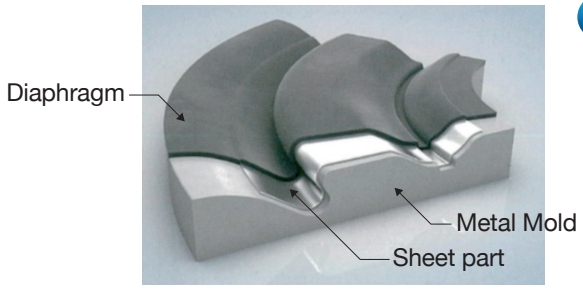
Structural Image





Quintus Technologies　Flexform™ Sheet Metal Forming

A sheet metal part having a complicated shape is formed by high hydraulic pressure through a rubber diaphragm.



QFC series standard

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Multi-Material Battery Case Concept for BEV

Benefits

- **Securing light-weight and strength resistance (ISO12405-3, GB31467.3)**
- **Original Dissimilar material bonding, ensuring strength and water-tightness**
- **Possible to select structural materials according to cost/light weight target**

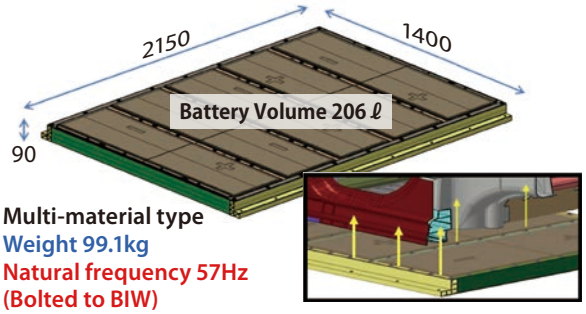
Construction

Features of the battery case structure

1. A multi-material structure that balances light-weight and low cost, based on a welded assembly structure.
2. Material composition
   Frame: Aluminum extruded material,
   Bottom panel: Steel, Inner R/F is made of High-strength steel and aluminum.
3. Applicable to lateral and bottom pushing strength.

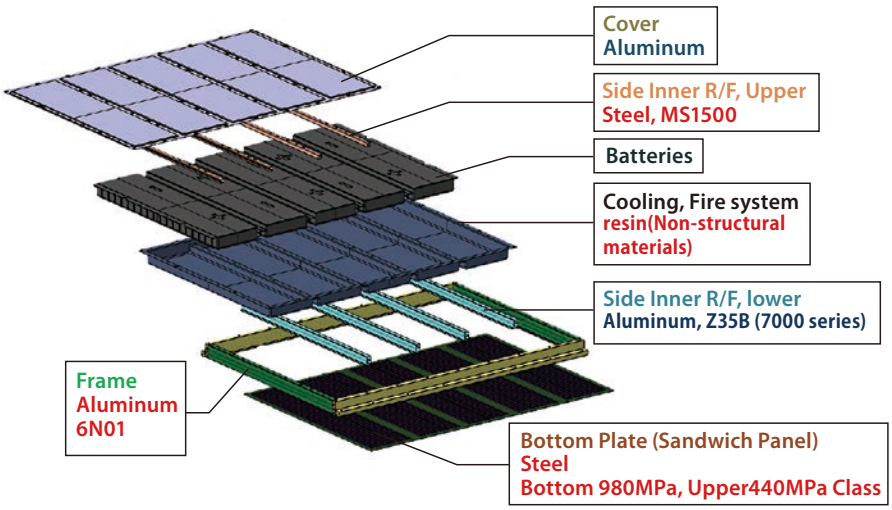
※1 Pushing side surface by Φ150 cicle, according to (ISO -3 12405 (2014), GB 31467.3 (2015)
※2 □30 square jig pushed from the bottom by the equivalent amount of vehicle weight.

External dimensions and mass performance

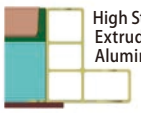
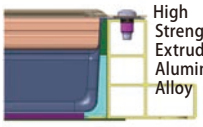
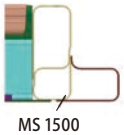


Multi-material type
Weight 99.1kg
Natural frequency 57Hz
(Bolted to BIW)

Inner structure view of multi-material type



Material selection and mass comparison, in same size and strength

 High Strength Extruded Aluminum Alloy	**All-Aluminum** 83.5kg
 High Strength Extruded Aluminum Alloy	**Multi-material Hybrid structure** 99.1kg
 MS 1500 High Strength Steel	**All-Steel** 126.3kg
vs (Tesla Model S) *) Same dimensions, strength is different	**Model-S case All-Aluminum** 114.6kg

Dissimilar metals joining process used in Multi-material type

EASW™ (Element Arc Spot Welding, Original Developed),
FCW brazing for Steel/Al (Original developed, Option)

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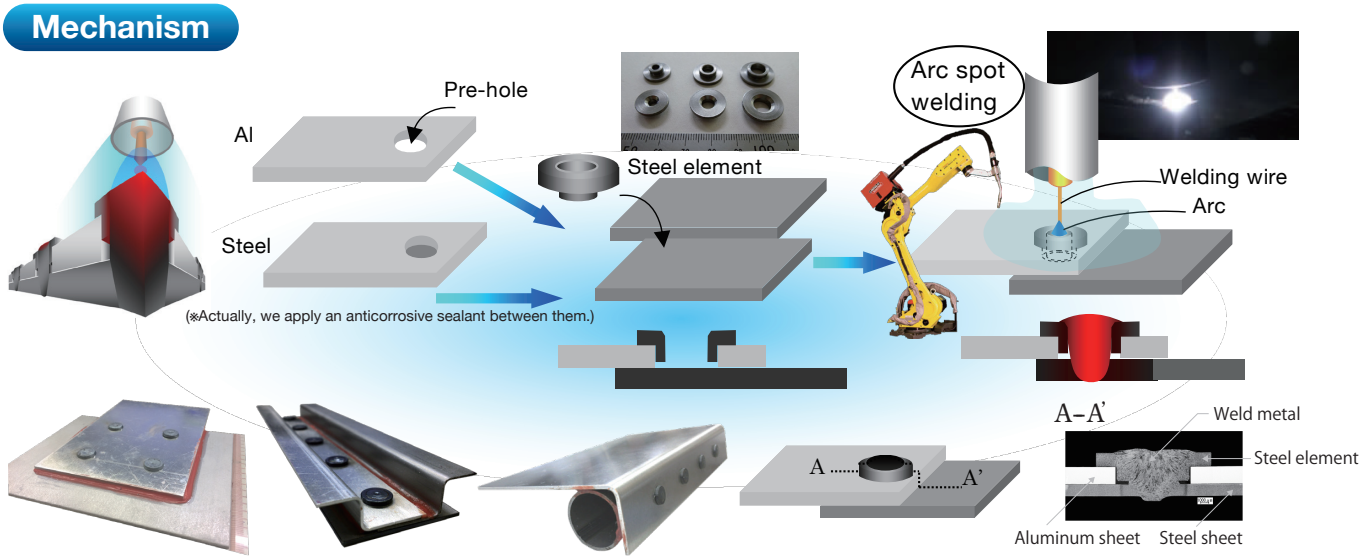
New dissimilar metals joining process "EASW" using arc with auxiliary insert

Benefits

- Aluminum alloy and Ultra-high tensile strength steel sheets can be joined strongly from one side without merging each other.
- Uses arc welding and Element (Rivet).
- The top performance has been verified by the industry-government-university collaboration project ISMA.

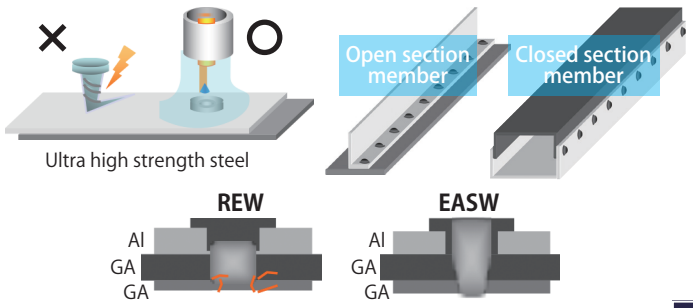
Construction

Mechanism

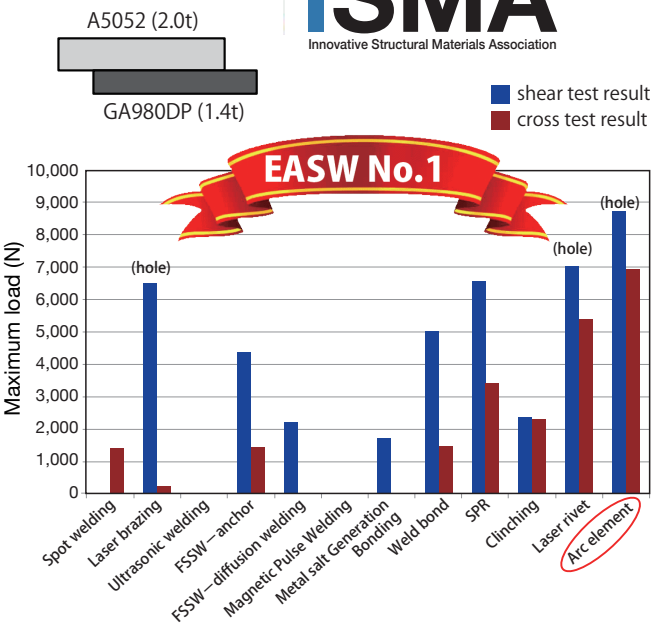


Characteristics

1) The joining strength is high.
2) It can be used for Ultra-high-tensile steel sheets.
3) It can joint from one side.
4) Applicable to both open and closed section members.
5) There is no fear of LME cracking even in galvanized steel sheets.
6) The penetration state can be confirmed from the backside appearance.
7) Applicable to repair joints (Can be manually operated.)



Strength



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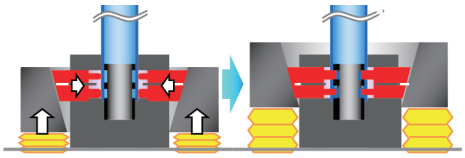
Dissimilar metal's pipes joint "3D-Joint" using multi-point deep drawing.

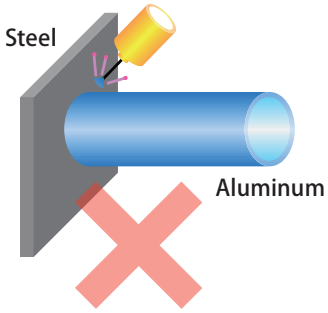
Benefits

- Existing arc welder production lines can be used.
- With inexpensive equipment, multiple points can be deep-drawn at the same time for firm fastening.
- It can cope with wide range of joint types such as orthogonal joint and parallel joint.

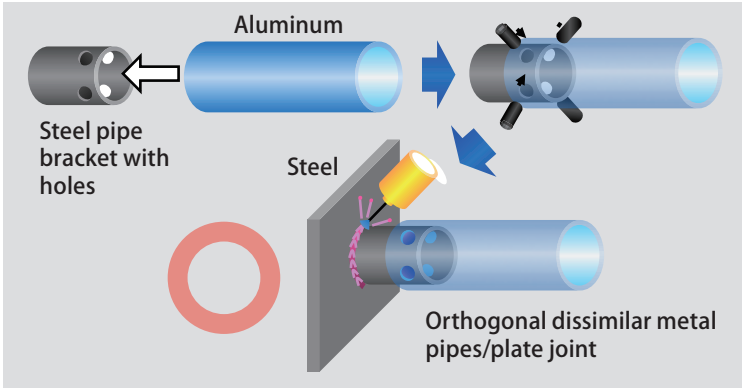
Construction

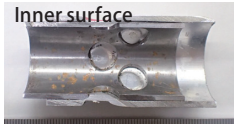


Direct arc dissimilar joint

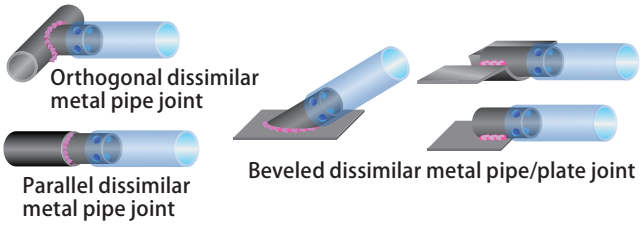


3D-Joint

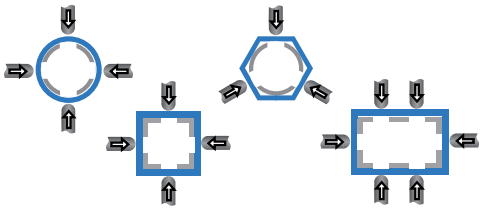




Joint types

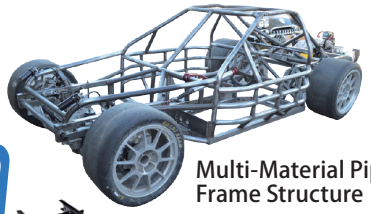


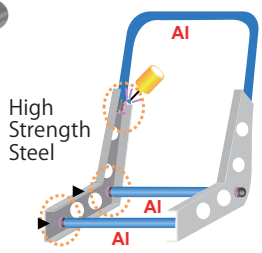
Cross Sectional combination of main pipe and bracket pipe

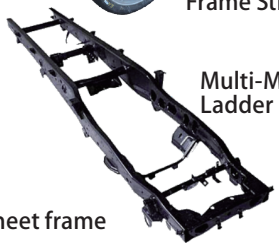


Sample

Image







Multi-Material structure of sheet frame

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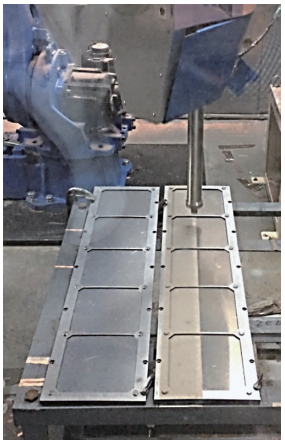
Laser Joining of Dissimilar materials Using Cold Spray Process

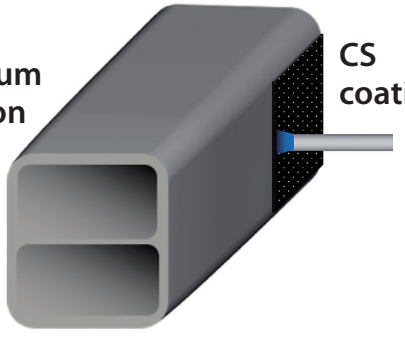
Benefits

- Ultra-high-tensile steel sheet and extruded aluminum alloy can be joined quickly.
- Pre-drilling of steel sheets and aluminum alloy is unnecessary.

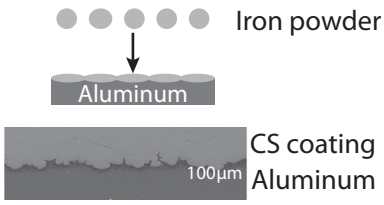
Construction

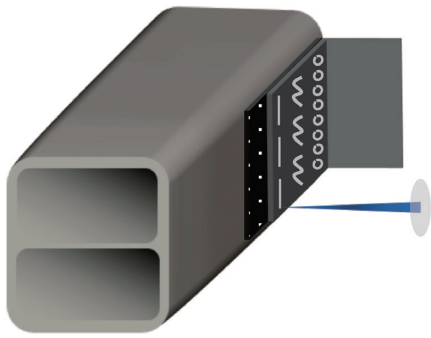
Outline of joining methods



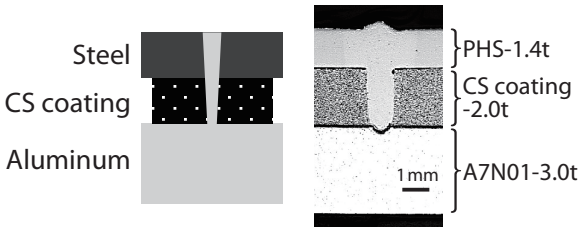


Cold spray (CS)

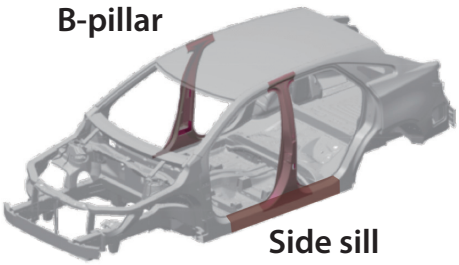




Laser welding



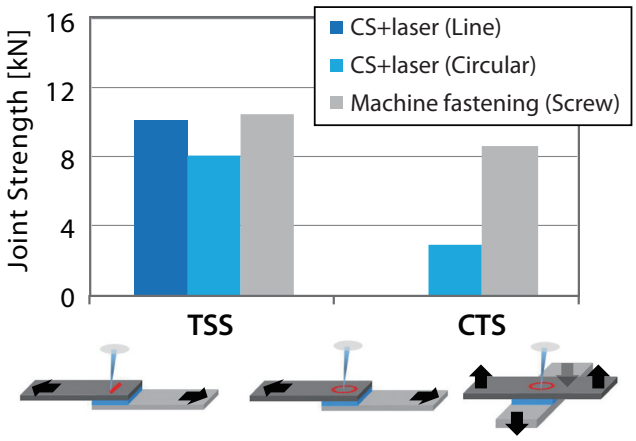
Assume application locations



simulated prototype parts

Joint characteristic

Steel Sheet; PHS-1.4t, Aluminum; A7N01-3t (with CS-2 t)
Heat Source; Fiber laser , Power: 5 kW, Welding speed: 4 m/min



linear welding
(Welding length: 18.8 mm)

Circular Welding
(Weld Diameter: 6 mm)

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