

# Newly Developed Galvannealed Steel Sheet with Excellent Press Formability: JAZ<sup>®</sup> (JFE Advanced Zinc)<sup>†</sup>

## 1. Introduction

In order to improve the corrosion resistance of automobile bodies, galvannealed steel sheets (GA) have become the mainstream in corrosion-resistant steel sheets for automotive applications. To date, numerous examples of research on the coating film structure and properties of GA have been reported<sup>1)</sup>.

On the other hand, improvement of the sliding property of the GA surface has become an important issue for solving pressing-related problems such as press cracking and enabling expansion of the application of GA to hard-to-form parts. Recently, against the background of increased use of high strength steel sheets and unitary forming of large-scale panels, there has been rising demand for GA with an excellent lubrication property.

JFE Steel carried out research and development for improvement of the lubrication property of the GA surface, and as a result, developed a new steel sheet, “JAZ<sup>®</sup>,” by applying a nano-scale surface reforming technique to GA. The concept of this technique is completely different from the conventional method of coating the product with a solid lubrication film. The following introduces the quality properties of “JAZ<sup>®</sup>,” focusing on press formability.

## 2. Basic Concept of JAZ<sup>®</sup>

The press formability of GA is affected by (1) the Zn coating layer, (2) factors such as adsorbed materials/oxides, etc. on the coating surface, and (3) the solid lubrication film coated/formed on the GA surface (Fig. 1).

To date, research has been carried out on the method of (3) coating a solid lubrication film on the GA surface as a means of improving the sliding property of GA, and GA with an excellent sliding property has been applied. Examples include 2-layer galvannealed steel

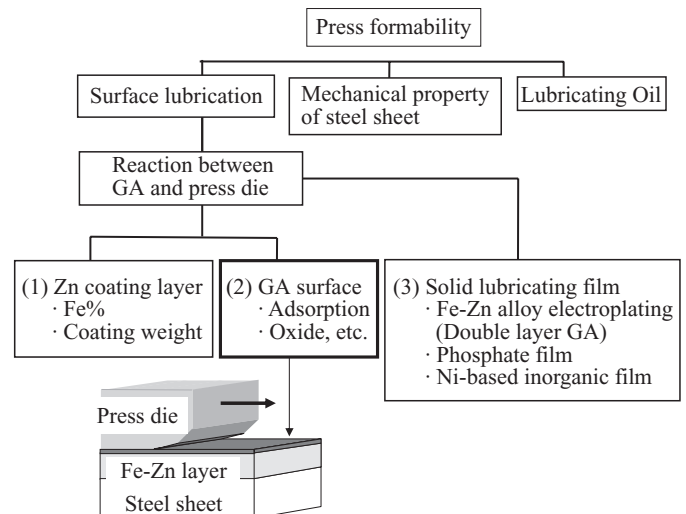


Fig. 1 Concept of newly developed product “JAZ<sup>®</sup>”

sheets (2-layer GA), in which Fe-Zn alloy electroplating or Fe-P electroplating with a high Fe content is applied to the surface of GA, and steel sheets on which a solid lubrication film such as a phosphate film or Ni-based inorganic lubrication film<sup>2)</sup>, organic lubrication film, etc. is formed.

In the development of JAZ<sup>®</sup>, research and development were carried out focusing on (2) reforming/control of the GA surface itself, based on a different concept from the conventional technologies, with the aim of suppressing adhesion between GA and the die (tool). As a result, an original GA surface modification technique was developed, leading to the successful development of a new GA with an excellent lubrication property, “JAZ<sup>®</sup>.”

## 3. Quality Properties of JAZ<sup>®</sup>

### 3.1 Sliding Property

Figure 2 shows the coefficients of friction of conventional GA and JAZ<sup>®</sup> obtained by the flat sliding test method (oiled condition). In comparison with GA, JAZ<sup>®</sup> has a low coefficient of friction, and thus has an excellent sliding property.

Figure 3 shows the coefficients of friction with-

<sup>†</sup> Originally published in *JFE GIHO* No. 16 (June. 2007), p. 54–55

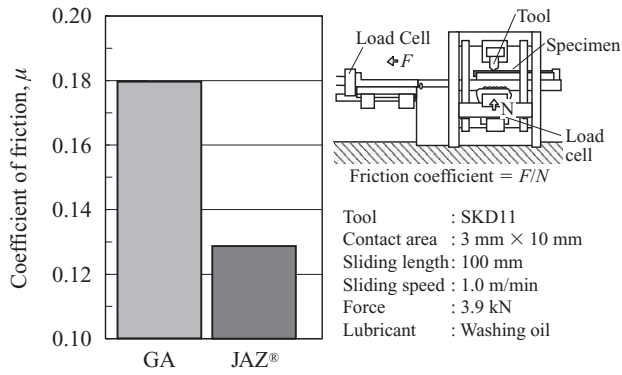


Fig. 2 Frictional property of GA and JAZ<sup>®</sup>

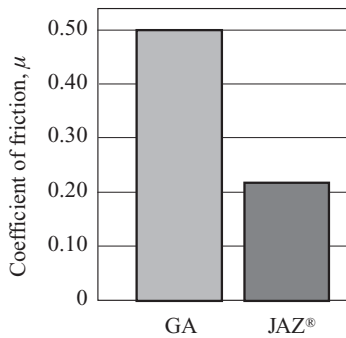


Fig. 3 Coefficient of friction without oil

out oil. Because the coefficient of friction of JAZ<sup>®</sup> is remarkably reduced in comparison with GA, the surface modification technique used with JAZ<sup>®</sup> is considered effective in suppressing adhesion with the die.

### 3.2 Press Formability

Using JFE Steel's 1 200 t press testing machine, an actual press forming test was performed with a model die of a front fender (Fig. 4). With the conventional GA, the formable range is 5 t, but in contrast, with JAZ<sup>®</sup>, the formable range is dramatically expanded, to 20 t, showing that actual press formability is improved.

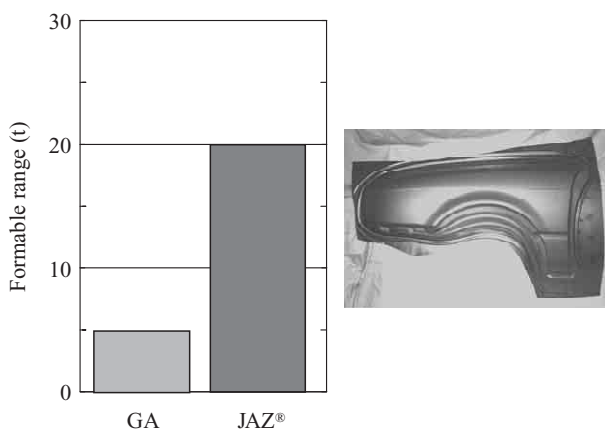


Fig. 4 Press forming test results of front fender with 1 200 t press machine

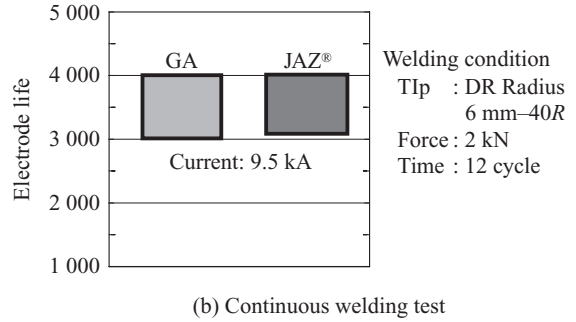
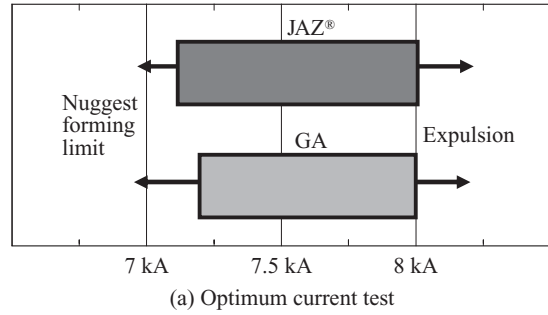


Fig. 5 Spot weldability of JAZ<sup>®</sup> and GA

### 3.3 Other Quality Properties

Figure 5 shows the results of spot weldability tests (optimum current test, continuous welding test (electrode life)). In both the optimum current test and the continuous welding test, JAZ<sup>®</sup> possesses properties equal to those of GA.

JAZ<sup>®</sup> also shows properties equal to those of GA for the adhesive property, phosphatability, ED paintability, and corrosion resistance.

### 4. Conclusions

JFE Steel developed JAZ<sup>®</sup>, a new GA with an excellent lubrication property, using an original surface modification technique. JAZ<sup>®</sup> has excellent press formability in actual press forming. JAZ<sup>®</sup> also has other quality properties (spot weldability, adhesion property, phosphatability, corrosion resistance) equal to those of conventional GA.

Among its features, JAZ<sup>®</sup> is an environment-friendly product because it contains no heavy metals or other harmful substances. Possible applications include side panels, fenders, doors, wheel houses, and other hard-to-form exposed panels and inner panels of automobile bodies.

JFE Steel has positioned JAZ<sup>®</sup> as a strategic product in high lubrication GA steel sheets for automotive applications. Mass production systems have been established at both East Japan Works (Chiba District) and West Japan Works (Fukuyama District), and full-scale supply to multiple auto makers has begun. The company has also completed installation of equipment at the hot dip

galvanizing line (CGL) at Guangzhou JFE Steel Sheet (China) and at No. 4 CGL at West Japan Works (Fuku-yama) and plans to expand supply in the future.

#### References

- 1) ISIJ. Coating Microstructure Properties of Galvannealed Steel

Sheet. 2004.

- 2) Sugimoto, Y. et. al. JFE Technical Report. 2004, no. 4, p. 50.

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