TOA Industries successfully controls springback in thin ultra-high strength steel stamping parts using PAM-STAMP 2G

The Automotive Division of TOA Industries Co., Ltd. manufactures vehicle body and suspension parts. There is strong pressure to reduce the weight of these components in order to cut CO₂ emissions without sacrificing safety performance. A solution is to use ultra-high strength steel, but this technological shift mustn’t lead suppliers to overlook automobile OEMs’ constant demand for the reduction of both development lead time and cost.

The most difficult problem in the manufacture of ultra-high strength steel components, given their exceptional yield stress, is dimensional deviation due to springback. To create dies for use with high strength materials in a short time frame and at low cost, springback must be prevented in the die from the design stage to minimize trial-and-error correction once the die is made.

Boasting a strong experience with PAM-STAMP 2G for crack/wrinkle prevention, TOA Industries has recently been analyzing springback and has found that on many components, conventional analytical methods are unable to predict springback accurately when ultra-high strength materials are used.

Figure 1 compares a physical test to PAM-STAMP 2G prediction results, when a 2.0mm thick 980MPa-class material is used for a Central Pillar. Analysis reveals a suitable correlation.

However, as shown in Figure 2, when a 1.2mm thick 980MPa-class material was used for a B-Pillar Inner, considerable gaps were observed.

Analysis of the behavior of blanks during the stamping process revealed that the B-Pillar Inner was subject to greater unbending deformation than the Central Pillar.

Mr. Masuyoshi Ueda
General Manager
1st Product Engineering Department
TOA Industries Co., Ltd.
TOA Industries Co., Ltd. (based in Ota City, Gunma Prefecture; “TOA”) manufactures components and materials for the automotive and housing industries. The company’s automotive business centers on body and suspension parts. Since its establishment in 1949, TOA’s business has grown to the point that it now has a total of six manufacturing facilities in Japan, including the head office and main factory. TOA is expanding its automotive components business, and regarding suspension parts it not only deals with domestic car makers but also with car makers overseas. In 2000, TOA built an automotive parts factory in Indiana, USA as part of a strategy geared to taking on the global market.

It is known that the stress-strain relation during unbending deformation is different from that during bending deformation, owing to the Bauschinger effect.

However, the Isotropic Hardening Material Model generally used in existing forming simulation is unable to take the Bauschinger effect into account. This impacted on the accuracy of springback prediction in the B-Pillar Inner.

TOA Industries therefore decided to apply the Yoshida-Uemori model, which makes it possible to take the Bauschinger effect into account.

As shown in Figure 3, the PAM-STAMP 2G predictions displayed appropriate correlation with the physically stamped panel, confirming that springback prediction could be accurate enough to be of practical use.

From the results of these initiatives TOA Industries concluded that mass production of components using ultra-high strength steel would be possible. Drawing on its technical expertise, components made of 980MPa-class ultra-high strength materials are now in mass production and being used in vehicles available on the market.

Figure 3: B-Pillar inner: PAM-STAMP 2G results with the Yoshida-Uemori model compare to physical testing, 95.8 % of the points within +/- 1mm

Figure 2: B-Pillar Inner: PAM-STAMP 2G results compared to physical testing, Isotropic Hardening Model, 52.3 % of the points within +/- 1mm

Mr. Nobuyuki Seki
Subsection Manager
1st Production Engineering Department
Stamping Engineering Section
TOA Industries Co., Ltd.

ABOUT
TOA INDUSTRIES CO., LTD.

TOA Industries Co., Ltd. (based in Ota City, Gunma Prefecture; “TOA”) manufactures components and materials for the automotive and housing industries. The company’s automotive business centers on body and suspension parts. Since its establishment in 1949, TOA’s business has grown to the point that it now has a total of six manufacturing facilities in Japan, including the head office and main factory. TOA is expanding its automotive components business, and regarding suspension parts it not only deals with domestic car makers but also with car makers overseas. In 2000, TOA built an automotive parts factory in Indiana, USA as part of a strategy geared to taking on the global market.

ABOUT
ESI GROUP

ESI is a pioneer and world-leading provider in virtual prototyping that takes into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product’s behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment’s impact on performance. ESI’s solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 800 high-level specialists worldwide covering more than 30 countries.

ESI Group Headquarters | 100-102 Avenue de Suffren | 75015 Paris | FRANCE | T. +33 (0)1 53 65 14 14 | F. +33 (0)1 53 65 14 12 | info@esi-group.com

All PAM- and SYS- product names as well as other products belonging to ESI’s portfolio are trademarks or trademarks of ESI Group, except specified proprietary mention. All other trademarks are the property of their respective owners - Specifications are subject to change without notice.

www.esi-group.com