Property Optimization of High Strength-Lightweight Seat Frame Using Design of Experiment

D. S. Shin[1], E. S. Jeon[1]

[1]Department of Mechanical Engineering, Graduate School, Kongju National University, Korea
[2]Department of Mechanical Engineering, Graduate School
(Industrial Technology Research Institute), Kongju National University, Korea

*Corresponding author: osjun@kongju.ac.kr

1. Introduction

One of the most important issues for optimizing the bending strength of certain products is optimizing the material property to provide the best performance while reducing the weight. Studies on optimizing the strength under a weight limit generally consider changing the material and shape. While changing the material generally yields the largest effect in terms of reducing weight, it may cause problems with safety, machinability, and economic efficiency.

2. Finite element analysis

The finite element analysis target is the folding seat of the SUV vehicle's. The results of the finite element analysis show that destruction occurs due to lightening and reinforced conditions. The finite element analysis shows the displacement and stress aspects. For safety-critical parts, an increase in thickness and application of high strength materials may be considered. In addition, for parts that are not safety-risk, the reduction in thickness and application of lightweight materials may be considered.

3. Material properties

The physical properties of the metal material were tested for accurate analysis of the parts. A tensile test was conducted in accordance with ASTM E8/E8M-15A, as shown in Fig. 1, and repeated five times. The data closest to the average values were used for the physical properties applied to the finite element analysis. Table 1 presents the defined physical properties. The basic units for the physical properties were millimeters, milliseconds, and kilograms.

Table 1 Physical properties obtained from the test.

ID	Symbol	Unit	Description
Name	-	-	SABC 1470
Density	ρ	kg/mm^3	7.932e-006
Young's modulus	E	GPa	160.5
Poisson's ratio	ν	-	0.3

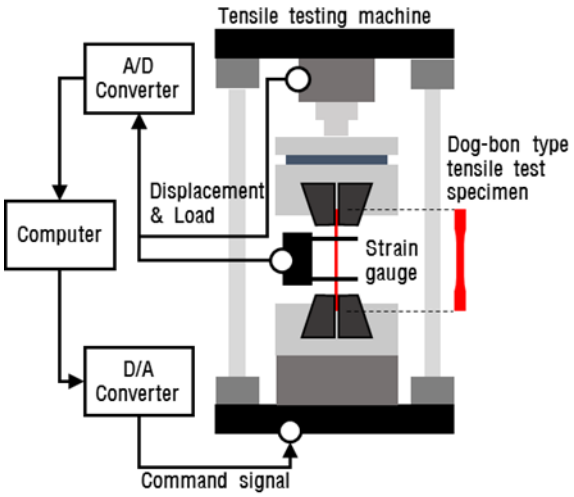

Fig.1 ASTM E8 E8M-15A

4. Property optimization

Applying the appropriate S-S curve and Thickness to the part requires a variety of experiments. Although it would be nice to take into account all the circumstances, the question of cost has led to the consideration of experimental planning in many engineering problems. In this issue, the experimental planning method was carried out using the Index of Thickness and S-S Curve.

Acknowledgment

This research was financially supported by the Ministry of Trade, Industry, and Energy (MOTIE), Korea, under the "Development of supply ecosystem advancement technology for Auto Parts Company(R&D, P0006973)"supervised by the Korea Institute for Advancement of Technology (KIAT).

References

[1] I. C. Lee, T.G. Lee, and D. H. Jang, Development Process of Side Impact Beam for Automotive Light-Weighting Door using Sheet Type, 24(2), (2015), 130-137