

Precision Extrusion Technology of Aluminum Thin-Walled Extruded Shapes for Notebook PCs

1. INTRODUCTION

With the growing diversification of customer needs in the electronic equipment in recent years, development of new products with competitive design is becoming essential. Under these circumstances, we have developed aluminum thin-walled extruded shapes to be used as the palm rest of a notebook PC that has been released based on a new design concept. The requirements for the aluminum extruded shape included: 1) to be thin and lightweight with a thickness of 0.7 mm, as well as to have high precision as a PC component enabling smooth assembly and mounting, and 2) to achieve appealing surface conditions with sharp ridgelines.

To meet these requirements, Furukawa Sky Aluminum has conducted studies including: 1) improvement of dimensional precision that affects the assembly and mounting accuracy, making full use of a numerical analysis software package that the Company has proprietary

developed to take various extrusion conditions into account, and 2) optimization of extrusion conditions to suppressing the generation of defects on the surface of aluminum extruded shapes which significantly deteriorates design quality. As a result of these studies, we have established a technology of manufacturing aluminum extruded shapes that meet these stringent requirements, thereby putting these materials in volume production.

The products shown in Figures 1 and 2 for their appearance have appeared on store shelves since February 2006.

2. OUTLINE OF PRECISION EXTRUSION TECHNOLOGY

2.1 Problems of Conventional Extrusion Technology

Figure 3 shows a schematic of extrusion process, in which a billet heated to high temperatures is placed in the container that is also heated, and the material is made to flow into the extrusion die to ultimately yield a product. Depending on the cross-sectional form of extrusion, it may happen to be difficult to obtain a desired cross-sectional form due to uneven flow of the material into the die.

Moreover, because extrusion is a kind of hot processing, its dimensional accuracy is generally lower than that of cold forming such as press forming of plates, under the influence of temperature changes during extrusion as well as due to thermal contraction after extrusion. Accordingly, even with the dimensional tolerance of special grade specified in the JIS standards, it has been considered difficult to manufacture extruded shapes applicable to components for electronic equipment of high precision.



Figure 1 Appearance of notebook PC using the product.



Figure 2 Appearance of palm rest.

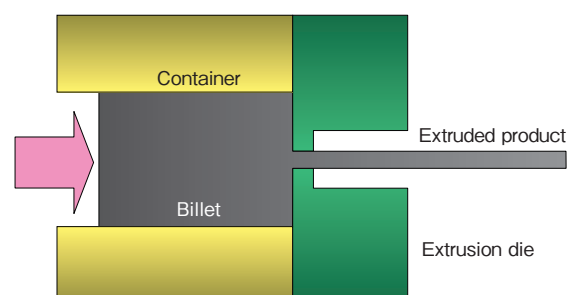


Figure 3 Schematic of extrusion process.

2.2 Development Subjects in Precision Extrusion Technology

To obtain aluminum extruded shapes of thin-walled, high-precision, and design quality, it is essential to optimize extrusion conditions as well as die configuration, so as to make the raw material flow uniformly into the extrusion die.

We have analyzed the flow of raw material during extrusion, using the Company's proprietary numerical analysis software that takes various extrusion conditions into account, thereby succeeding in understanding the conditions in designing an extrusion die that ensures uniform flow of raw material into the die. Analysis examples given in Figures 4 and 5 show that the material flow near the opening of the extrusion die is fairly uniform. We have fabricated an extrusion die based on the optimum design conditions, and optimized actual extrusion conditions including extrusion speed, billet temperature and die temperature. In this way, we have established a manufacturing technology of high-precision yet attractive aluminum extruded shapes that satisfy the stringent requirements such as dimensional accuracy, sharp ridgeline and appealing surface conditions.

3. HIGH-PRECISION EXTRUDED SHAPES AND THEIR DESIGN QUALITY

The palm rest component developed here has employed hairline treatment for the surface, and this has presented important tasks to be addressed such that blunting of the sharp ridgeline due to grinding during hairline treatment should be suppressed, and that the entire surface should

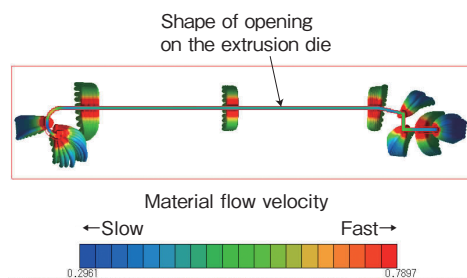


Figure 4 Results of numerical analysis of material flow velocity distribution (I).

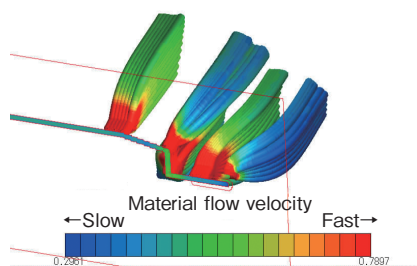


Figure 5 Results of numerical analysis of material flow velocity distribution (II).

be attractively and uniformly hairline treated. It was therefore required to have aluminum extruded shapes of high precision free from surface defects such as die mark and striped pattern, because these can damage the design quality when hairline treated. And this task of hairline treatment has been solved by using the aluminum extruded shapes manufactured by the precision extrusion technology developed here by our Company. Figure 6 shows an enlarged photograph of the ridgeline.

Figure 7 shows an appearance of the extruded shape before and after hairline treatment. The extruded shape with a wall thickness of 0.7 mm has achieved the dimensional accuracy of 1/2 to 1/5 the special grade specified in JIS for overall areas, and not greater than 0.35 mm for flat areas in particular, thereby allowing for uniform hairline treatment. Moreover, generation of surface defects on the extruded shape has been suppressed stringently, so that the palm rest component made of an aluminum extruded shape has been accomplished that offers sharp ridgelines showing characteristic design together with appealing surfaces realized by hairline treatment.

4. TASKS FOR THE FUTURE

Aluminum extruded shapes enable enhancement of functions by providing metal components with various forms ---e.g. ribs to hold mounting circuit boards, screw holes to fasten other components, etc. It is also possible to offer a variety of components that present excellent design quality while taking advantage of metal texture of alumi-



Figure 6 Enlarged photograph of the ridgeline.



Figure 7 Aluminum extruded shape. Upper: As hairline treated. Lower: As extruded.

num, by combining hairline surface treatment mentioned here and coloring alumite finish.

In the future, we intend to expand the application of shaped components to the electronic equipment business field where high-density mounting is required more and more, thereby promoting the development of diverse products that meet the customers' needs. If you have a case in need of assistance or a requirement for us, please contact the undermentioned point of contact.

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