“LineArt CHARMANT”-optical frame composed of nickel free super-elastic titanium alloy

Charmant Inc

1. Market Background

95% of eyewear manufacturing in Japan is concentrated in Fukui prefecture. Under recent competitive circumstances, creating a new value for Japanese products is what is facing Japanese manufacturers in this day and age since in the market on the higher priced end, mainly Italian manufacturers have the license to produce fashion brand name eyewear while there is an increase in the proportion of inexpensive eyewear from China, where their strength lies in their cheap labor.

2. Recent Requirements for Optical frames

One of the recent design requirements requested to frame manufacturers in addition to current resistance brazing technique, was a new joining techniques to obtain strong and smooth joint finish for an ever expanding variety of extremely fine parts.
Our R&D has worked for many years on materials used and frame architecture to develop optical frames of ever improving wearing comfort. The material developed is a nickel free super-elastic titanium alloy which has a low tensile modulus (Young’s modulus) and wide elastic range.
From an architectural standpoint it was noted that some products in the market were formed with thin wires with a diameter of around 1.2mm and some of them had insufficient joint strength due to negative thermal effect at joint sections, especially if the wire was of titanium.

3. Development of Nickel free Super-elastic Titanium alloy(“Excellence Titan”)

The goal was to develop a titanium alloy which is biocompatible, high strength and has a low tensile modulus (Young’s modulus). Superelasticity at room temperature was accomplished by adding Al to an alloy mainly consisting of Ti, Nb and Zr, and decreasing martensitic transformation temperature and solid solution strengthening. Further adjustment was made in order to commercialize “Excellence Titan” for optical frame. Through evaluating heat treatment dependence, Al composition was adjusted to control the change in characteristics around the aging temperature 300°C for surface treatments in eyewear production.

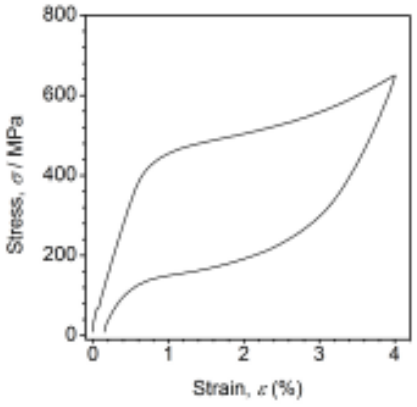

Fig. 1 shows an elasticity of “Excellence Titan” (load-unloads tested where the strain was less than 4%).

4. Development of the Laser micro-welding technique

Our challenge was to achieve both strong and smooth finish for the joint sections for frame architecture which uses thin wires.
Inferior strength and surface quality of the joining parts were the result of sparks due to the size tolerance of the parts, uneven heat distribution between parts and thermal affect on large surface left by resistance brazing.
By using laser welding and reducing the diameter of the irradiation, a new problem solving technique has been established, which enables a much smaller surface to be thermally affected which consequently improved the quality of the joint section.

Fig. 2 shows a close-up of Laser micro-welded sections (on each temple)

5. Outline of the Product

Product planning and development was made under the theme of “user oriented optical frame which is light, gentle and is a secure fit - which provide a never experienced wearing comfort by harmoniously fusing the highly innovative material, advanced processing technologies and excellent design.”
The developed optical frame has an unique and original architecture composed with thin wires less than 1mm (Fig. 2). Temples are flexible in both twisted and horizontal directions (Fig. 3) to provide multi level fitting by utilizing our accumulated head size data base. Thus, this allows the optical frame to maintain its strength while providing a surprising lightness, gentle and secure fit along with intricate unique designs.

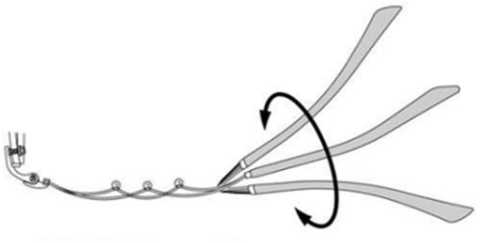

Fig. 3: The characteristic of the temple part against twists

6. Sales Results

Unit sales in Japan reached around 240,000 by the end of 2011 and an estimated 36% share of the premier segment. For overseas, 280,000 units have been sold since January 2011. The result proves the importance of a product with a new value in the optical frame market which was experiencing a continuous decline in the average sales per customer.

7. Conclusion

Charmant provides reliability, confidence and pleasure to our customers as well as a comfortable eye-life with optical frame. The company continues to strive to provide the world with a life vision with our competitive products against global competitions through Japanese R&D and product planning.