New products

Development of Cut and Sewed Skin Wrapped Instrument Panel

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Abstract

The instrument panel installed in Nissan’s new GT-R adopts cut and sewed skin wrapping for minor model change in 2016. This specification, where a plastic base panel is wrapped in a three-dimensionally sewed skin made of genuine or synthetic leather, has recently been used in premium-segment vehicles in Europe. The instrument panel with cut and sewed skin wrapping has strong product appeal due to its high level of craftsmanship. However, the manufacturing process requires a lot of manual work because several cut skin parts need to be sewed together accurately and the skin needs to be attached to a complex-shaped panel without puckers. Furthermore, no quality variation between the products is allowed. Therefore, it is hard for designing and manufacturing. We have overcome these issues and made it possible to mass produce this instrument panel.

Key Words: Instrument Panel / Cut and Sewed Skin, Wrapping

1. Introduction

In recent premium segment models, particularly those of European brands, instrument panels wrapped with cut and sewed skins have been taking the place of those formed with powder slush molding skins (hereafter called formed skin instrument panel). For wrapping the instrument panel with the cut and sewed skin, cut pieces of genuine or synthetic leather are three-dimensionally sewed by manual operation of sewing machines, and the sewed leather is also manually bonded on the instrument panels.

In response to this trend, we newly developed a cut and sewed skin wrapping instrument panel which has suitable quality to luxury cabin spaces in the premium-segment vehicles (Fig.1).

2. Structure of Cut and Sewed Skin Wrapping Instrument Panel

The formed skin instrument panel is composed of formed skin, foam, and plastic substrate layers. The urethane foam layer is placed in the middle to bond the skin and substrate together (Fig.2).

On the other hand, the newly developed instrument panel is layered with a three-dimensionally sewed skin, a cushion material, and a plastic substrate. Each layer is bonded with an adhesive (Fig.3).

Fig. 1 New GT-R instrument panel
(http://www.nissan.co.jp/GT-R/interior.html)

Fig. 2 Structure of formed skin instrument panel
Development of Cut and Sewed Skin Wrapped Instrument Panel

3. Assembly Method of Cut and Sewed Skin Wrapping Instrument Panel

The formed skin instrument panel is assembled by placing the formed skin and the plastic substrate on inner surfaces of molds and injecting a urethane material in between them to form the foam layer that bonds the skin and the substrate.

In contrast, the newly developed instrument panel is assembled in the following order. Firstly, after applying an adhesive to the cushion material and the plastic substrate, those layers are manually bonded. Secondly, after applying an adhesive to the three-dimensionally sewed skin, it is also manually bonded to the cushion material which was layered on the plastic substrate (Fig.4).

4. Solution for Feasibility in Cut and Sewed Skin Wrapping Instrument Panel

As previously mentioned, the structure and the production method of the newly developed instrument panel differ from the formed skin instrument panel. Those differences raise the following issues in the production processes:

- Accuracy of three-dimensionally sewed skin form
- Stability of adhesive strength
- Accuracy of stitching position

From the following section, the discussion turns to how we solved these issues.

4.1. Accuracy of Three-Dimensionally Sewed Skin Form

While the skin for the conventional instrument panel is molded in three dimensions, the skin for the newly developed instrument panel is three-dimensionally formed by sewing cut pieces of leather. Inaccurately formed skin may not match with the mating substrate shape, causing puckers and non-adhesion of the skin.

Accuracy of the three-dimensional skin form depends on the “pattern” which is a template for leather cutting. In conventional developments, patterns were created from the product design based on knowledge of experts. Then, a skin was prototyped by cutting/sewing along the patterns and bonded onto a plastic substrate. If any puckers or other failures were identified in the bonded skin, the patterns were modified and a re-prototyped skin was bonded to the substrate again. The pattern-making required many man-hours and a long preparation period for the repetitive trials.

To solve this issue, we used a CAE analysis technology that simulates a sewed skin form with pattern models, enabling a significant reduction of the trials (Fig.5 and 6).
4.2. Stability of Adhesive Strength

In the formed skin instrument panel, the skin and substrate layers are bonded with the urethane foam which is formed by injection molding. On the contrary, an adhesive is used to bond the three-dimensionally sewed skin, the cushion material, and the plastic substrate in the newly developed instrument panel. This structure requires the stable adhesive strength on the entire instrument panel surface. If it is unstable, the skin may peel off, degrading its appearance quality.

To stabilize adhesion strength on intricately formed instrument panels, we established a new production process through understanding the adhesion mechanism, environmental loads in vehicles, and characteristics of the skin. The established process secures the stable adhesion strength on the entire product surface (Fig.7).

![Fig. 7 Peeling strength of skin](image)

4.3. Accuracy of Stitching Position

The skin for the newly developed instrument panel is sewed by manual operations of sewing machines and then manually bonded to the plastic substrate without puckers. These manual operations may cause positional deviation of the stitch lines (meandering, etc.) on the instrument panel surface due to skin elongation and stretched conditions during the bonding process.

The stitches not only three-dimensionally form the skin but also play the major role in the decorative appearance. Especially, since the instrument panel is placed at a noticeable position in the cabin, the accuracy of the stitch line is significantly important.

We secured accuracy of the stitch line position by contriving the instrument panel structure and applying a special jig in the production process (Fig.8 and 9).

![Fig. 8 Appearance of the finished stitch line](image)

![Fig. 9 Result of the accuracy verification](image)

5. Concluding Remarks

The newly developed technology extends design and production capabilities that can cover instrument panel specifications for higher grade vehicles. Furthermore, since this development involved members in the design, production engineering, and test groups as a concurrent engineering activity, high quality products can be mass-produced with less production variations.

We will globalize this technology and promote it to achieve higher goals.