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Fusion of "design" and "function" based on decorative film

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In recent years, the number of cases where decorative films are used for resin cover panels used for center information displays and the like is increasing. Since it is necessary to reduce the reflection of external light in order to improve the visibility of the display, the decorative film is required to have not only the design but also the surface reflection reducing function. When the surface reflection reducing function is imparted to the decorative film, any one of AG, AR, and AGAR is used. However, since AG is more cost effective than AR or AGAR, there are cases where an AG-treated decorative film is required.

When performing AG treatment on a decorative film, it is necessary to provide an ink layer containing particles on the film in order to form an uneven shape that diffusely reflects incident light. However, by performing AG treatment on the decorative film, the entire surface of the molded product becomes whitish after molding, so that the required design may not be satisfied. In order to improve the design, it is required to give smoothness to the surface of the design part and to form unevenness only on the surface of the part corresponding to the image display area of the display. In this paper, we examined whether the in-mold transfer foil can achieve both design and functionality.

First of all, in order to confirm the effect of the size of the unevenness of the in-mold transfer foil on the visibility, three types of inorganic particles having different particle sizes were added to the ink and evaluated. The test piece using the inorganic particles with the smallest particle size had the lowest anti-glare and the highest degree of white blur. It is considered that if the anti-glare is improved, the degree of white blur becomes higher and the adverse effect on the visibility becomes larger. Therefore, it is judged that it is difficult to improve anti-glare by using these inorganic particles. Next, comparing the test piece using the inorganic particles with the largest particle size and the test piece using the inorganic particles with the medium particle size, the test piece using the inorganic particles with the largest particle size had higher anti-glare and lower haze. Since there was no significant difference in the degree of white blur and sparkle between these test pieces, the inorganic particles with the largest particle size, which were superior in terms of anti-glare, were used (Table 1).

Secondly, it was examined whether the visibility could be optimized by reducing the amount of the inorganic particles added to the ink forming the uneven part. Since the haze decreased as the amount of inorganic particles added was reduced (Fig. 1), anti-glare, white blur and sparkle were evaluated for each amount added (Table 2). The purpose of the AG treatment is to provide anti-glare, but it is required to minimize the deterioration of image quality. Since the anti-glare was relatively high and the degree of white blur was relatively low at the additive amount of 0.2%, the additive amount was decided to be 0.2%.

In this development, the in-mold transfer foil was treated with AG only on the surface of the part corresponding to the image display area of the display, and the visibility was optimized, so that both design and functionality could be achieved.

Table1 Display visibility due to particle size

Particle size	Anti-glare	Haze(%)	White blur	Sparkle
Small	Average	20.7	Poor	Excellent
Medium	Very good	13.05	Good	Good
Large	Excellent	11.08	Good	Good

Table2 Display visibility due to additive amount

Additive amount	Anti-glare	White blur	Sparkle
0.1%	Good	Very Good	Good
0.2%	Very Good	Very Good	Good
0.4%	Excellent	Good	Good
0.6%	Excellent	Good	Good
0.8%	Excellent	Good	Good
1.0%	Excellent	Good	Good

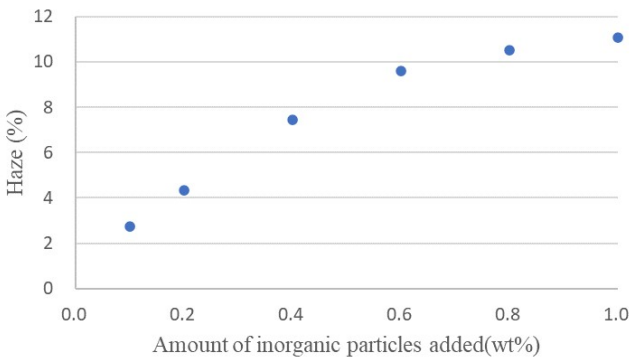

Fig.1 Relationship between additive amount and haze