Anti-Fingerprint UV Curable Hard Coatings

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1 Summary

Recently, touch panels have been applied to a wide range of consumer products such as car navigation systems, smart phones and tablet PCs, and the market has been expanding year by year.[1] As input is achieved mainly by touching with a finger, there is a strong requirement to solve the problem of fingerprints.

In this report, the development of new hard coatings by making a lipophilic surface is described. These coatings enable fingerprints to be wiped off easily, making them indiscernible.

2 Features of Developed Product

- By introducing a lipophilic group to acrylic resin, the contact angle of oleic acid, the main component of fingerprints, is reduced from 22° of conventional products to 8.5°.
- Visibility is remarkably improved by the lipophilic surface of the hard coatings.

3 History of Development

Figure 1 shows the cross section of a touch panel. A hard coating is mainly applied to prevent scratches and grime on the cover film. Recently, the demand for preventing grime has been increasing. It is a conventional way of preventing fingerprint grime to make the surface of the hard coating water-repellent and oil-repellent by using fluorine[2] or silicone materials.[3] However, in such a conventional way, fingerprint grime is noticed after being wiped off under diffuse reflection of outside light.

We thought that reducing the contact angle of the surface would be effective to suppress diffuse reflection of the light and to make fingerprints less noticeable.

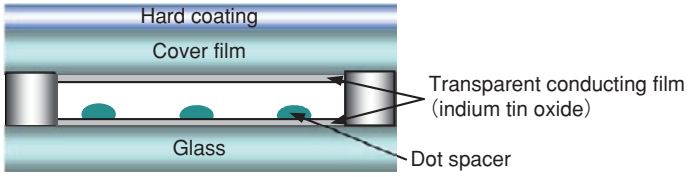

Figure 1 Cross section of touch panel[4]

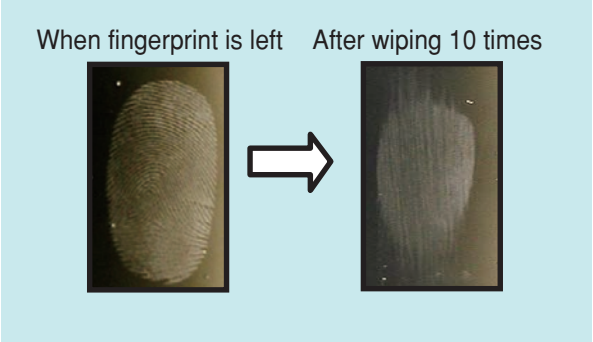

Figure 2 Anti fingerprint property of water and oil repellent hard coating

4 Content of Technology

(1) Resin Design

Figure 3 shows the molecular structure of the developed hard coating. A lipophilic group is introduced into the polymer system by using our original synthesis technology. This group makes ths surface lipophilic after UV hardening process. Also, to maintain the hardness and the adhesion to the cover film, our original acrylic resin which includes reactive double bond is used as base resin.

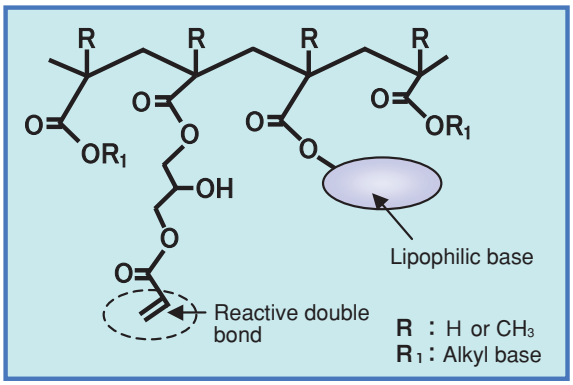

Figure 3 Illustration of developed hard coating

(2) Evaluation of Fingerprint Resistance

Figure 4 shows the results of comparisons between the surface conditions of the lipophilic hard coating we developed and those of the conventional hard coating. The contact angle of oleic acid on the conventional hard coating is 22°, and it shows little change as time passes. On the other hand, the initial contact angle of the developed hard coating is 8.5°. After 60 seconds, the contact angle decreases, which shows the affinity to oleic acid increases.

Next, we investigated the relationship between lipophilicity and visibility by measuring the contact angle of oleic acid and the haze. The results are shown in **Figure 5**. After the fingerprint is wiped, though the haze of the conventional products is 1.5%, the haze of the developed products is 0.3% and its visibility is excellent. When contact angle is about 10° or less, the haze after wiping becomes lower than 0.5%, which makes fingerprints not noticeable.

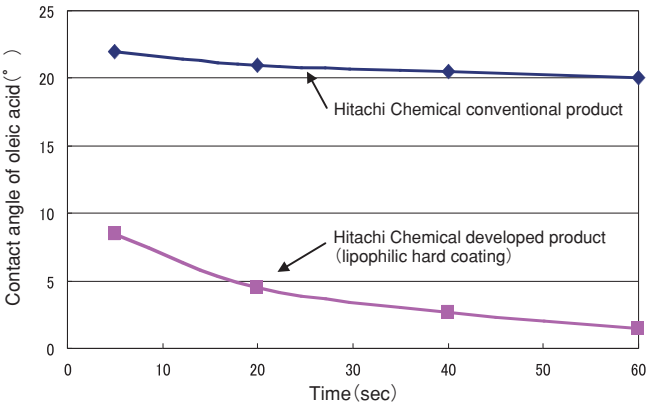

Figure 4 Comparison of contact angles of conventional product and developed product

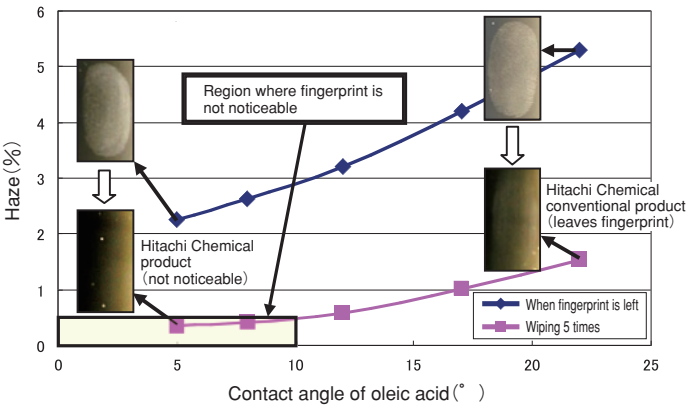

Figure 5 Relation between oleic acid contact angle and haze

5 Future Developments

- Investigate making the coating harder (pencil hardness of 5H or greater)
- Apply to glass substrates

【References】

1) Senoo: Display Monthly, Vol. 16, No. 12, pp. 6-9 (2010)
2) Japanese Published Unexamined Patent Application No. 2000-144097
3) Matsuo: Conferring Fingerprint and Scratch Resistance to Grime-resistant Technology and Quantitative Evaluation Method, pp. 29-34, Technical Information Institute Co., Ltd. (2010)
4) Okubo: Nikkei Electronics, 137 (2006)