

Korean market overview

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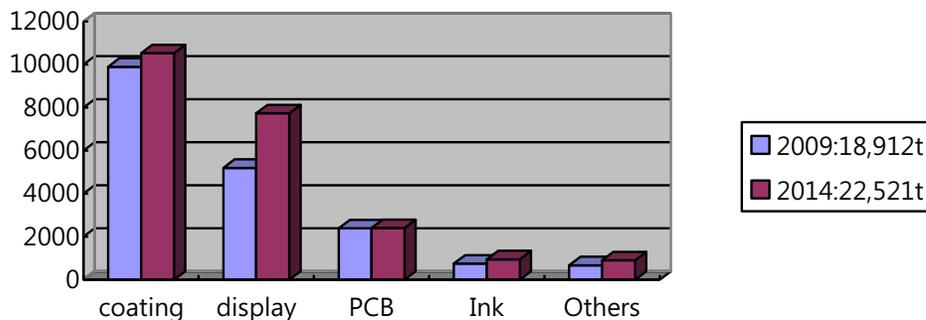
Introduction

Like other countries, South Korea began to use UV curable coating for furniture in the early 1980s. At the beginning, high price of imported coating and investment for imported UV dryer have been obstacles. However, with local formulators' active product development and performance improvement of local made UV dryers, Korea has made rapid growth on UV curable paints. Especially, high productivity by UV curing went well with Koreans. Nowadays applications of UV curing are not only on conventional wood, PVC floorings, plastics, PCB, UV offset ink, cellular phone, automotive head lamp, solar control film, but also on fiber optics, optical films, color filters(eg, color resist, Black matrix, column spacer) for TFT-LCD, electrodes and barrier rib for PDP. From this year onwards, new applications like UV curable coil coating, etc will be introduced.

While UV technology has been prosperous in Korea for last 30 years, adoption of EB technology for conversion was very much limited due to its high price.

Body

As you can see on the graph 1, market size of UV curing in Korea is expected to be about 19,000 tons in 2009. Among them, Coating takes 52% of total market with 9,900 tons and followed by Displays(27% with 5,200 tons), and followed by PCB(13% with 2,400 tons). Details of each application are as follows.



[graph 1 : Market Size]

As you can see in the graph, we expect that display market will grow very sharply during next 5 years. However coating and inks markets will make steady growth and PCB market will be stagnated.

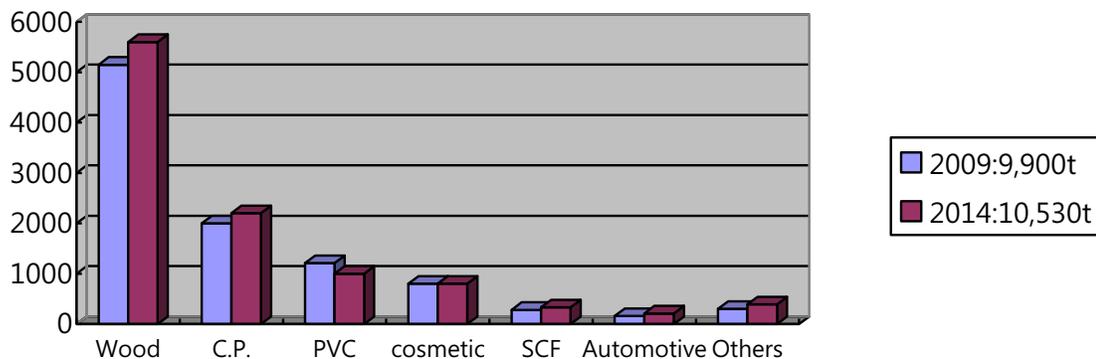
-.Wood

The Korean wood market consists of conventional plywood, parquet and furniture which includes one coat pigmented system or direct shining system. Conventional coating had been making steady growth until 1998. After 1998, which was the year of the Korea's economic crisis, industry was looking for cheaper products, resulting in adoption of paper/film lamination. And then, conventional coating market growth slowed down or decreased.

The parquet market has rivalry with PVC cushion vinyl floorings which are used at home. As improvement of Korean's living standard, parquet has increased its share on the market and became the major part of the industry. Hereafter, the parquet market will continue to maintain its high growth. Water borne system for isolator, etc, is widely used..

One coat pigmented system began to use on furniture in the early 90's and was booming until 1998. Since then, change in fashion and consumer request of cheaper furniture made it almost completely disappeared from the market except kitchen furniture. About several years ago, however, it was revived by 5~6 coating speciality companies.

The market size of parquet is 2,150t/y and plywood is 3,000t/y.



[graph 2 : Coating Market]

-.Optical film

Optical films that are used for back light unit of TFT-LCD are prism sheet, DBEF(Double Brightness Enhanced film), MLF(Micro Lens Film) which was developed by a local venture in 2002, hybrid film, etc. MLF has midway characteristics between prism and diffuser and is used for TV. After 3M's patent expired a few years ago, Prism sheet is produced by about 10 local companies in Korea.

DBEF is still monopolized by 3M with its patent. However, a few local companies are developing alternatives to DBEF by taking CLC (Cholestecric Liquid Crystal) technology or imprinting technology or press roll technology. One or two out of the abovementioned technologies seems to be commercialized this year, even though there is concern about their price competitiveness against DBEF.

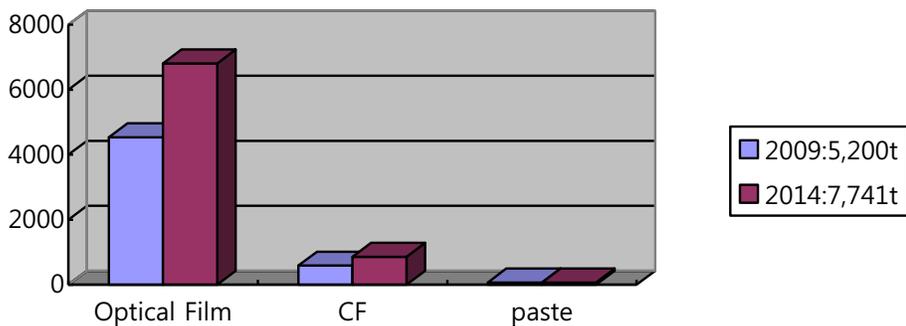
Hybrid film(prism + diffuser) is mostly used on monitors.

Most of coatings that are used for optical films have been usually produced by film makers for captive use. Since last year, however, the competition of the finished goods in price has gotten tougher. As a result, film suppliers tend to outsource the coatings from resin suppliers or coating specialties, in order to cut down the cost. Also, local made oligomers are mostly used but some special ones are imported.

For the high refractive index(RI) prism sheet, only halogen free oligomers have been used by the set maker's request. Current RI before curing is about 1.50~1.58. However, higher RI of 1.60 is requested especially for LCD-LED TV for cost reduction by reducing the number of LEDs used.

Film production companies are separated into two groups. That is, subsidiaries of big conglomerates like Samsung and LG and small/medium sized specialty companies. The severe competition between film suppliers has made their profits decreased. As a result, one large film manufacturer decided to shut down the plant at the end of last year and restructuring of the industry seems to be followed further soon

The market size for optical film is 4,540tons/y(graph 3)..



[graph 3 : Display Market]

-.Cellular phone

Korea has 2nd (Samsung) and 3rd (LG) largest cell phone suppliers in the world. Those two companies' total sales are estimated to be about 400 million units last year. Among them, about 100 million cell phones, which are complicated in design and requiring high technology, are produced in Korea. Other mass production models are done in other countries like China and Vietnam.

UV curable hard coating, mold coating, adhesive are used for display window, key pad, main body of the cell phone. The total consumption of oligomers and monomers is estimated to be 2000t/y last year.

Local cell phone makers wanted to use environmentally friendly water borne system for UV curable clear coating a several years ago. However, it wasn't successful yet because of lack of suitable resins which can meet the stringent specification, especially in leveling and gloss. Recently halogen free coatings are adopted, as requested by Samsung and LG.

The market share of smart phone using touch panel is still small but launching of the iphone

would make its share increase rapidly, possibly to 20% this year. Obviously, growth of the usage of touch panel will decrease the usage of key pad.

-.PVC floorings

For Koreans, flooring has a lot more meaning than in other countries. The reason is that we've been using floor heating system, Ondol, which had been invented during Joseon dynasty in 13th century. Until today, Korean houses and flats use floor heating system instead of radiator.

In case of house flooring, it has been traditionally made of paper. In the late 80's, LG Chem. launched PVC floorings which adopted UV curable clear coating first time in Korea. And its usage was extended to cushion vinyl flooring, heavy duty flooring, step by step. In about 10 years later, market size of UV clear increased up to 2,500 t/y. However, as I mentioned previously, PVC floorings have been replaced by parquet. So, PVC flooring market is still decreasing.

The current market size of PVC floorings is 1,210ton.

-.PCB(Printed Circuit Board)

PCB is used in two ways. One is FR4 grade of copper clad laminate (CCL) for industrial purpose which use Photoimageable Solder Resist(PSR), etch resist, DFR(Dry Film Resist). The other is FR1 grade of CCL for the home appliances which use UV screening inks.

In case of PSR, Taiyo Ink(Korea) has more than 50 percent of market share in Korea and 3 or more local companies are active. UV LDI(laser direct imaging) for PSR is also being developed, even though its high price is a major obstacle to be adopted.

Conventional DFRs are supplied by a local company (Kolon) or Japanese manufacturers. However, some local PCB manufacturers have been already using UV LDI (365nm or 405nm) technology.

The PCB production company, Samsung Electro-material started to make switch from conventional UV ink to UV inkjet ink in marking. Etch resist would be a next application of UV ink jet ink in future.

The market for conventional type of PCB is no longer increasing. But the production of flexible PCB is increasing rapidly, thanks to cell phones, etc

-.UV inks

The main application of UV offset ink is carton pack in Korea and followed by silk screen for bottles, etc..

Use of UV flexo ink is very much limited to narrow web only until now but not for wide web. Flexographic Printing plates are all imported mainly from Japan. However, a few local local companies are trying to develop it.

An imported UV inkjet inks are mostly used. However, one local company has developed their own inkjet ink and increases its shares in the market, even though it's still small in volume.

The overall UV ink market is relatively small in Korea, compared with other applications. Subsequently, there would be significant potential for the growth in future.

The current market size is 750 t/y.

-.Adhesive/PSA

In case of UV curable adhesive and PSA, its applications were limited to electric part and double-sided tape, etc in the past. Meantime, they have been extended to dicing tape/ die attached film for wafer, films for FPD and cell phones, etc. Unfortunately, however, it's so difficult to get an idea about total market size because of small quantity but many different items or use of imported adhesive

UV hot melt adhesive was introduced in western countries relatively long time ago. However no local company has adopted UV curable type yet because end-users are too small to invest money for it.

-.UV lamp

In the late 1980's, the first MP Hg lamp has been commercialized to be used for PVC flooring. Since then, several local companies are supplying MP Hg, metal halide lamps(e.g. Fe doped, Ga doped).

The market share for the MP Hg lamp is the largest just like other countries. Fe doped lamp is expanding its usage from offset ink and pigmented system to clear coating, especially for those products which needs high adhesion property.

The quality for MP Hg lamp seems to be comparable to the one of the best quality lamps worldwide. But for the metal halide lamps, local companies seems to have insufficient technology to produce high quality ones. Thus, mini-doping seems to be widely used.

Price competitiveness of local made lamps are very strong.

-.UV dryer

At first, small manufacturers who were involved in specific applications gained their market share. However, most of them went belly-up, resulting from lack of essential technology for new applications after the one they got involved was matured. Nowadays a few local manufacturers are leading the market.

Imported curing equipments are a lot more expensive than local ones. Accordingly, imports seems to be limited to heat sensitive substrate (eg,PET film) application and new applications like in electronics and FPDs

-.EB accelerator

Three low voltage (<300KV) EB accelerators have been used in Korea. That is, one by a multinational company for beverage packaging, another by a local company for retro-reflective film and the other by a steel company for pigmented coil coating. The last one has only survived unfortunately, however.

Finding new applications which can justify high investment seems to be a prerequisite for expansion of its usage.

Conclusion

For the last 30 years, radiation market in Korea has been developing very rapidly in volume. However, its growth in general coating applications has been slow down. In case of inks, potential for the growth is big but no sharp increase is anticipated. On the other hand, FPD market will continue to quite nicely grow, thanks to an expected new investment by Samsung and LG Display. Overall 4~5% yearly growth is expected Korea during next 5 years.