

Applications and Progress of UV/EB Curing Technology in China

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Abstract

The increasing environmental concerns and ongoing legislation to cut the emissions of volatile organic compounds (VOCs) have been the major driving force in China in recent years. UV curing is now being increasingly used in various industrial sectors and still predominant compared with EB curing technology in China.

This report summarized the production outputs and values in 2006 according to the survey from 116 leading companies, including 36 that produced raw materials, 72 that manufactured UV formulations and 8 that supplied UV lamps and equipment. The output growth rates of raw materials and UV formulations were 32.9 % and 16.4 %, respectively. The production value growth rates for raw materials, UV formulations, and UV lamps and equipment were 47 %, 17.6 % and 63.4 %, respectively. The total growth rate of 32.8 % in 2006 compared with 27.6% in 2005 was obtained.

The detailed market information for 2007 will be presented further during RadTech UV/EB Technology Conference & Expo 2008, May 4-7, 2008 due to the collection delay reason.

Raw materials

Figure 1 and Figure 2 show the production volumes and values of multifunctional monomers from 2003-2006. The output of monomers increased from 36,528 tons in 2005 to 48,024 tons in 2006 with a rate of 31.5%, while production value from 122.92 million US\$ in 2005 to 205.71 million US\$ in 2006 with a growth of 67.3 %. The volumes of TMPTA and TPGOA were over 12,000 tons, and HDDA, DPGOA and EO-TMPTA over 3000 tons. The total export volumes were over 7000 tons.

The oligomer is another important component for a UV curable formulation. Although most of them were imported formerly, the production of oligomers in China increased rapidly in recent years. In 2006, the output of oligomers was 27,420 tons with a growth of 38.3 % compared with 19,825 tons in 2005. The production value increased to 100.94 million US dollars with a growth of 88.9 %. Now, not only the common kinds of oligomers such as epoxy acrylates, aromatic urethane acrylates, aliphatic urethane acrylates, but also some polyester acrylates, amide acrylates, alkaline-developable acrylates were manufactured in large scale by Chinese companies. The variety became more abundant and the products started to export to foreign countries. In 2006, the total export volumes exceeded 2500 tons.

The production of photoinitiator has shown the fastest growth rate in recent years in China's UV markets. The photoinitiators not only meet the need of the domestic markets but also are exported to foreign markets. The output of photoinitiators increased from 16,995 tons in 2005 to 22,053 tons in 2006 with a growth of around 30%. Among them, the output of BP, 184 and 1173 for each exceeded 4000 tons, while 651, 907, and TPO for each over 1000 tons. The total export was around 16000 tons with a growth rate of 21.1% compared with 2005. The cationic, visible and macromolecular photoinitiators were also manufactured in certain scale. The production value increased from 48.18 millions US dollars in 2005 to 70.3 millions US dollars in 2006 with a growth of 14.9 %.

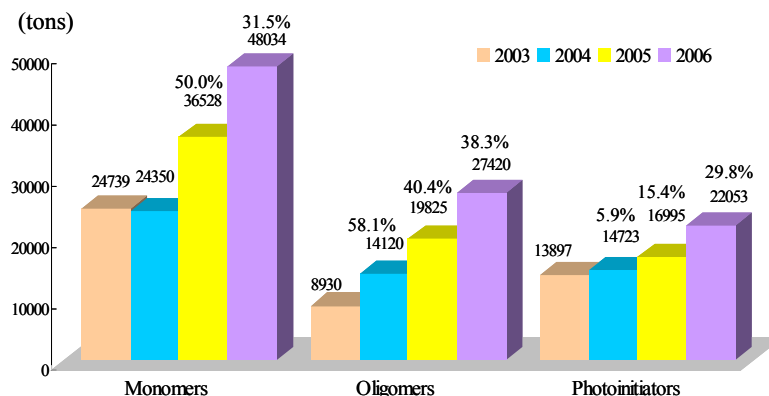


Figure 1 Production volumes of multifunctional monomers in 2003-2006 (ton).

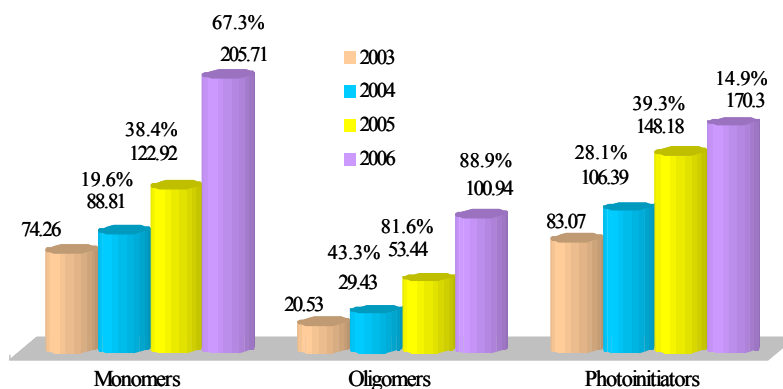


Figure 2 Production values of multifunctional monomers in 2003-2006 (mil. US\$).

Formulation Products

It is natural for the high market growth to meet the demands and requirements of the fast national economy development and for the production along with consumption, to start from a lower volume basis. However, in the latest three years the upgrading of domestic output, quality and values of radiation curing products has become even more significant in comparison with the past years. Moreover, their applications have also expanded to some new fields. Figure 3 shows the production output in tons for UV

curing markets from 2003 to 2006. The coatings and inks remain the largest application areas for UV curable materials in China. In the past years although a part of radiation curable products were imported, the products produced by Chinese manufacturers expand rapidly. The total outputs of radiation curable coatings from 43 manufacturers and inks from 36 manufacturers were 29,027 tons and 12,894 tons, respectively, in 2006. As a result, the growth in production volume was 16.0 % for coatings and 16.8 % for inks compared with 2005. The coatings for plastic casings, mobile phone, vacuum plating, and electronic applications have been expanded greatly except for the common uses in wood/bamboo flooring, paper and PVC industries. The total exports in 2006 were 211 tons for coatings and 98 tons for inks.

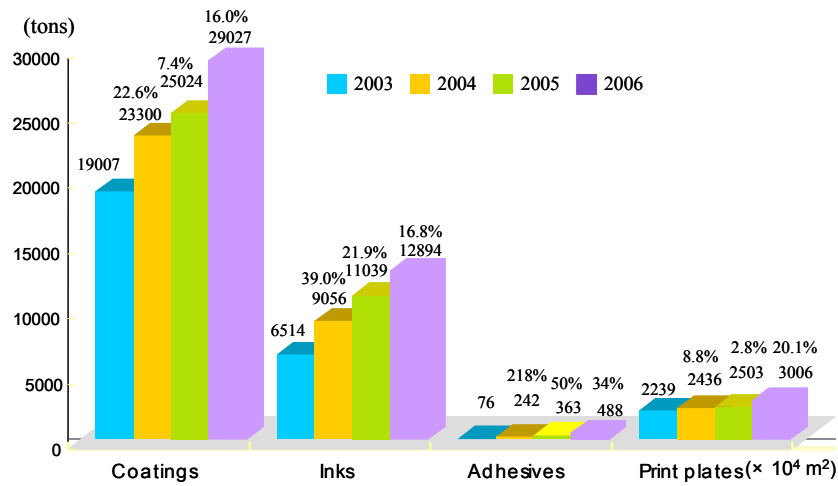


Figure 3 Production output for UV curing markets from 2003 to 2006 (ton).

Figure 4 shows the production values for UV formulations from 2003 to 2006. In 2006 the total production values of UV coatings was 138.4 million US\$ with a growth rate of 17.1, and that of UV inks 121.6 million US\$ with a growth rate of 13.1% compared with 2005.

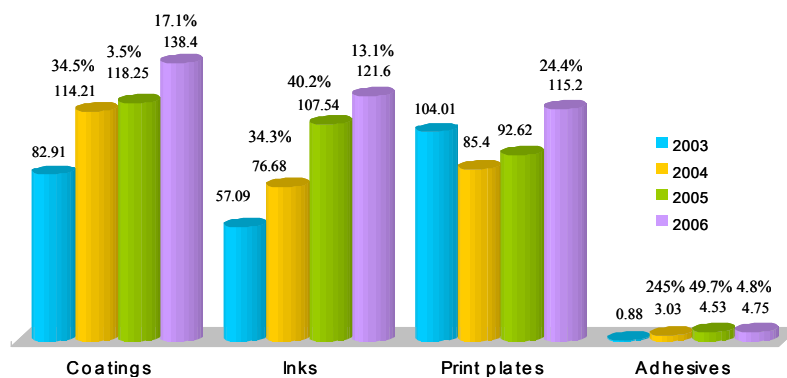


Figure 4 Production values for UV curing markets from 2003 to 2006 (mil. US\$).

The output for radiation curable adhesives was 488 tons in 2005 by 13 corporations compared with 363 tons in 2005 with a growth rate of 34%. Besides the adhesives were used in medicine, glass,

craftwork, packing, fishing equipment, those for LCD, DVD, instrument and optic applications have been also produced and have a nice beginning for the import replacement.

UV Product Markets

Figure 5 shows the status of coatings for diverse markets. The major markets of UV curable coatings are wood/bamboo, flooring coatings and PVC coatings. The overprint for paper is another important market. There are still numerous areas where radiation curable systems have barely penetrated, such as automotive coatings, anti corrosive coatings, metal coatings and electronic appliances.

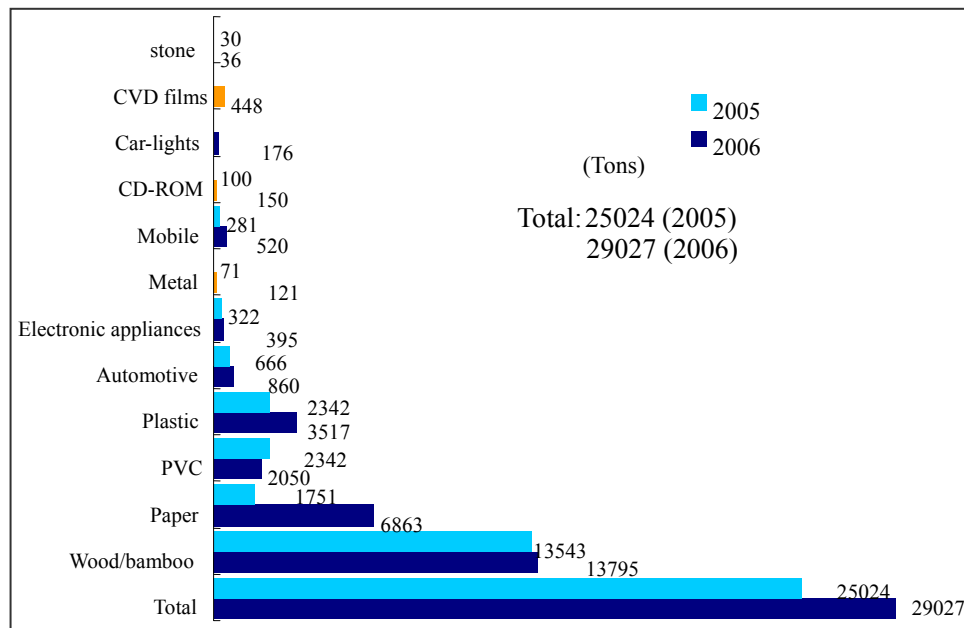


Figure 5 Output of UV coatings in 2005 and 2006 (ton).

The industrial wood/bamboo coatings still represent the largest share of end-uses. Other segments like plastic coatings and high-grade coatings for mobile phone and optical disk seem to inject a high level of stimulation into the markets.

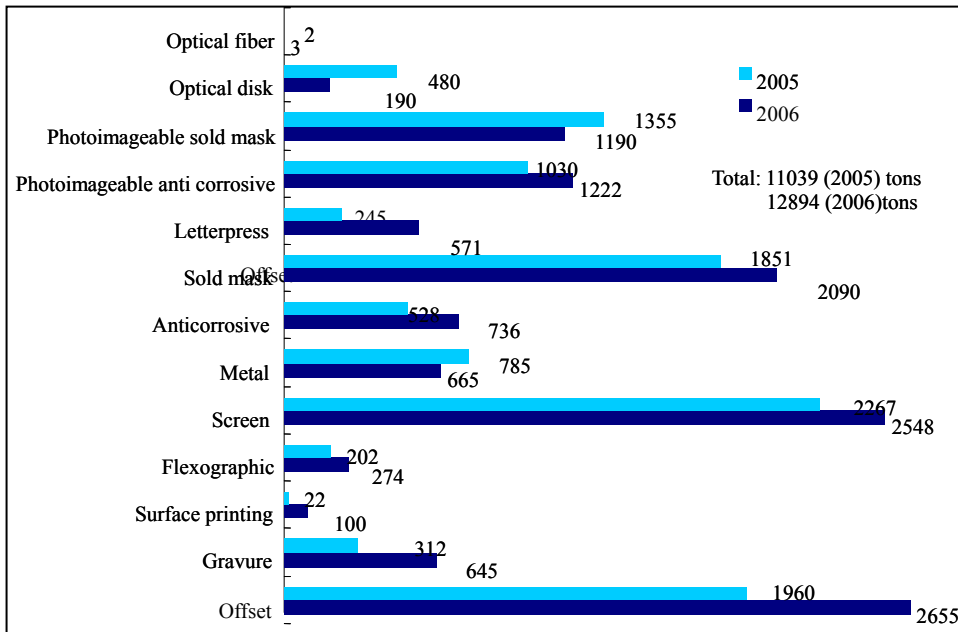


Figure 6 Output of UV inks in 2005 and 2006 (ton).

For the UV ink markets, as shown in Figure 6, it can be seen that the fastest growing areas in China are still screen inks and the whole gamut of offset printing from simple news inks to high gloss inks or web offset inks. The UV offset inks increased from 1960 tons in 2005 to 2655 tons in 2006 with a growth of 35 % which is almost the same rate of 34% from 2004 to 2005.

UV Equipment

The production of 7 companies that produced lamps and 8 that produced UV equipment as well lines related to UV curing showed a great increase compared with 2005. 296 thousands UV lamps were manufactured in 2006 with an increase of 35 thousands lamps compared with 2005. 2385 UV curing equipment were produced and 204 lines were established (Figure 7 and Figure 8).

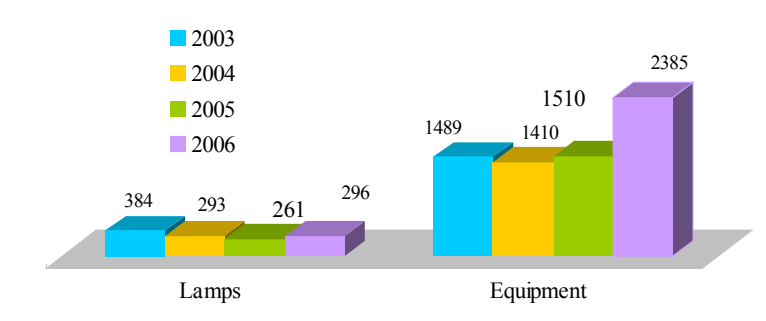


Figure 7 Outputs for UV equipment

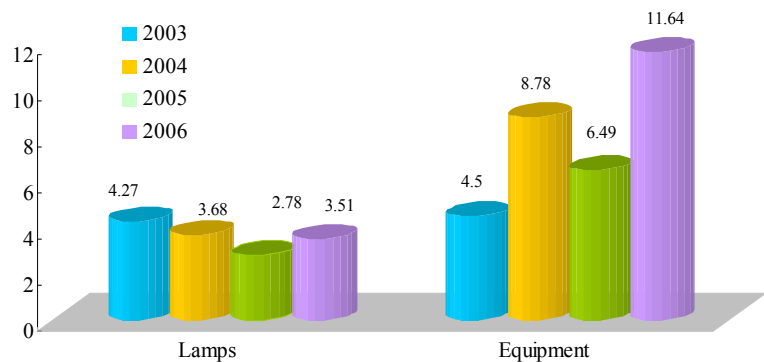


Figure 8 Values of UV equipment (mil. US\$).

Development of corporations involved in UV curing

ISO 9001 or ISO 9002 has certified 74 among 116 corporations surveyed in 2006, increasing 10 than 2005. Around 150 patents were applied and certificated by 18 corporations, increasing 64 applied patents than 2005. The output of more than 33 corporations exceeded one thousand tons, increasing 6 corporations than 2005, while over 5 thousand tons were produced by 6 corporations in 2006, and 2000-5000 tons by 14 corporations compared with 10 in 2005 (Figure 9 and Figure 10).

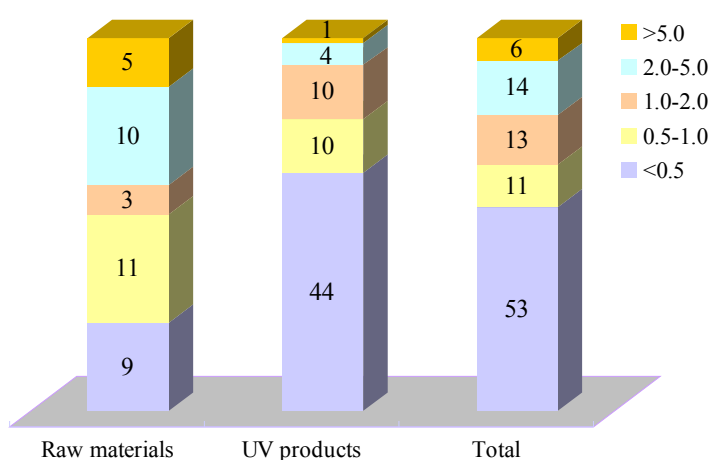


Figure 9 Development of corporations involved in UV curing (1000 tons).

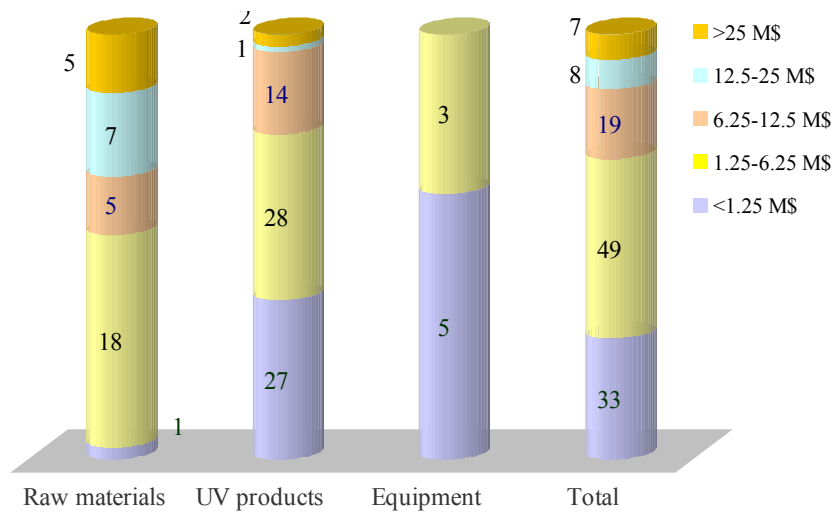


Figure 10 Development of corporations involved in UV curing (mil. US\$).

Conclusions

This short overview of Chinese market has shown that there are still many opportunities for developing radiation curing technology and its applications. High growth will continue in well-established areas (wood and paper coatings, screen and offset inks, etc). A major effort will be made in order to develop new technologies and new raw materials (waterborne coatings and inks, powder coatings, etc.), and enter into new application fields (composite and gel coats, automotive OEM and refinish coatings, etc.).