

Drycoater for PDP

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PDP Drycoater - External View

This picture shows the external view of the PDP drycoater equipped with an image-processing-based board positioning unit.

With the popularization of digital image-processing technologies and the deployment of broadband networks as part of an information system, the display market has changed drastically and plasma display panels (PDP) have entered into full-scale commercial production as the products best suited for our “digital society.” Multiple large glass panels are taken from one larger glass panel to reduce manufacturing costs, which is the key factor in the further popularization of PDP. To treat such large panels, we developed the PDP drycoater, which can laminate a dry film (DFR) onto panels of the largest size. The new machine also supports an industry-first feature: i.e., the DFR can be changed automatically. In summary, the PDP drycoater has the following advantages:

- (1) A glass panel up to 1,460 mm in width can be treated.
- (2) The new lamination system provides constant film tension and uniform lamination quality.
- (3) The new lamination system protects the laminated film from film-end wrinkling and the inclusion of Void.
- (4) The backup roll system provides highly uniform lamination pressure.
- (5) The automatic DFR change function increases both the operability and productivity of the machine.

1 Introduction

With the increase in the volume of information to be handled, larger and more accurate glass panels are needed. Two 42-inch (diagonal dimension: 107 cm) panels are taken from one glass panel. On the 62-inch (diagonal dimension: 157 cm) panel, the dimension of one side exceeds 100 cm.

The PDP consists of front and rear glass panels, which are treated separately in the first stage and bonded to each other in the later stage. As shown in Figure 1, the drycoater is used in this panel treatment process. The DFR is used in the patterning process and a film approximately 25 μm in thickness must be laminated over the entire surface of the large glass panel in order to meet the resolution requirements. In the conventional DFR

lamination process, the temporary film-adhering technique has been used. In this technique, the end of the film is temporarily press-fitted onto the panel and cut according to the length of the panel. With this temporary press-fit technique, however, the inclusion of air bubbles resulting from temporary press-fitting of the film, non-uniform lamination quality due to fluctuation in the film tension attributable to film cutout during the process, and the inclusion of air bubbles at the film end are unavoidable. In addition, the lamination roll (a heated roll) used to press-fit the DFR is affected by the deflection that is enlarged in proportion to the roll length, thereby decreasing the uniform press-fit performance in the lateral direction and preventing the production of large high-quality glass panels.

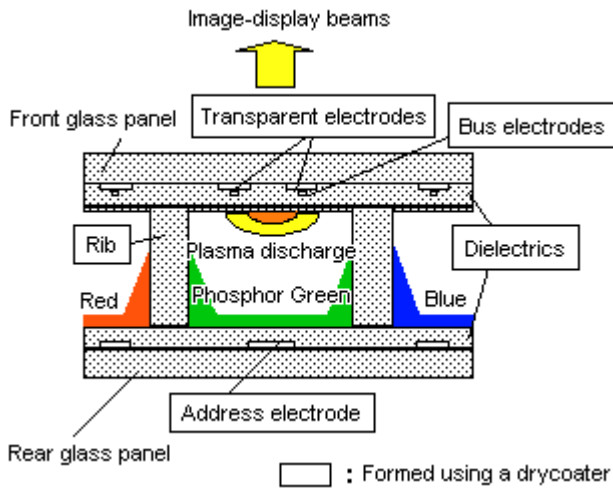


Figure 1 Application Example of a Drycoater for PDP

This figure shows the structure of a PDP, and the drycoater is used to form transparent electrodes, ribs, and dielectrics.

To solve these problems, we developed a new PDP drycoater featuring a continuous film lamination system.

2 PDP Drycoater

2.1 Features of the PDP Drycoater

The PDP drycoater has the following features:

- (1) Employment of a continuous film lamination system free from in-process fluctuations in film tension

Because conventional temporary film-adhering systems laminate the DFR onto the glass-panel surface as in the case of tiles, the DFR must be cut during the lamination process and as a result the tension changes substantially before and after the cutout operation. The continuous film lamination system pretreats the DFR to facilitate adhering to the glass panel (i.e., the resist is removed and the DFR is cut along the perforation) prior to the lamination, eliminating in-process film cutout.

This new design eliminates fluctuations in film tension during the lamination process. In addition, the pretreatment of DFR can “tile” the films even with the use of the continuous-lamination system. Figure 2 outlines our new continuous-lamination system.

- (2) Increased lamination pressure uniformity

In the conventional system in which both the DFR and glass panel are sandwiched by two rolls (upper and lower rolls), the uniformity of the lamination pressure is significantly impaired with an increase in the panel width, resulting in low pressure at the center section of the rolls and thereby decreased adhesiveness of the DFR. In addition, non-uniform lamination will wrinkle the DFR and trap air bubbles. To provide uniform lamination, convex backup rolls are installed above and under the upper and lower lamination rolls as shown in Figure 3, and the actual lamination pressure is controlled by adjusting the

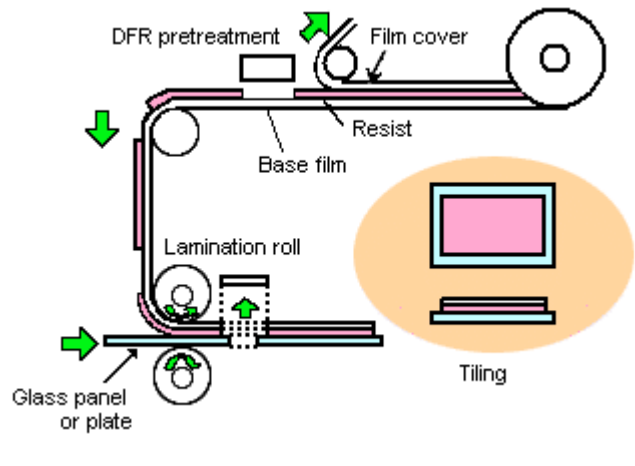


Figure 2 Continuous-lamination system

The continuous-lamination system does not cut the film before the lamination roll, thereby eliminating the inclusion of air bubbles at the panel end.

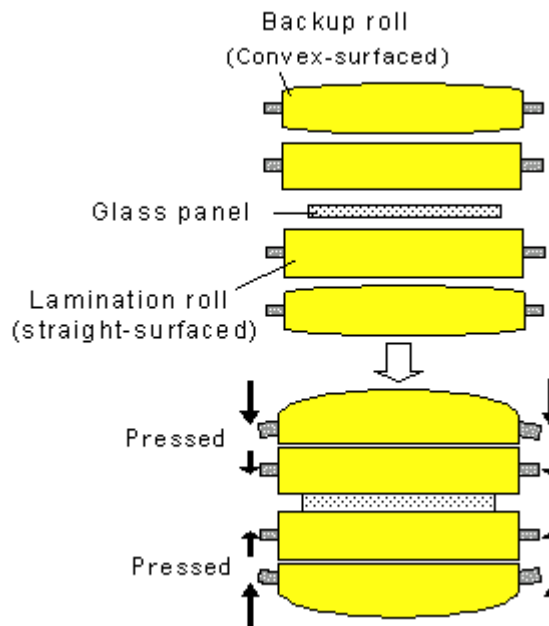


Figure 3 Backup-Roll Press System

This figure illustrates the mechanism for the backup-roll press system used to help the lamination roll adhere the DFR to the glass panel with uniform lamination pressure.

pressures on the lamination and backup rolls. Concretely, the system optimizes the lamination pressure by controlling the pressure of the lamination rolls with the pressure of the backup rolls maintained at a constant level. Figure 4 shows a comparison of the lamination pressures with the new and conventional roll designs.

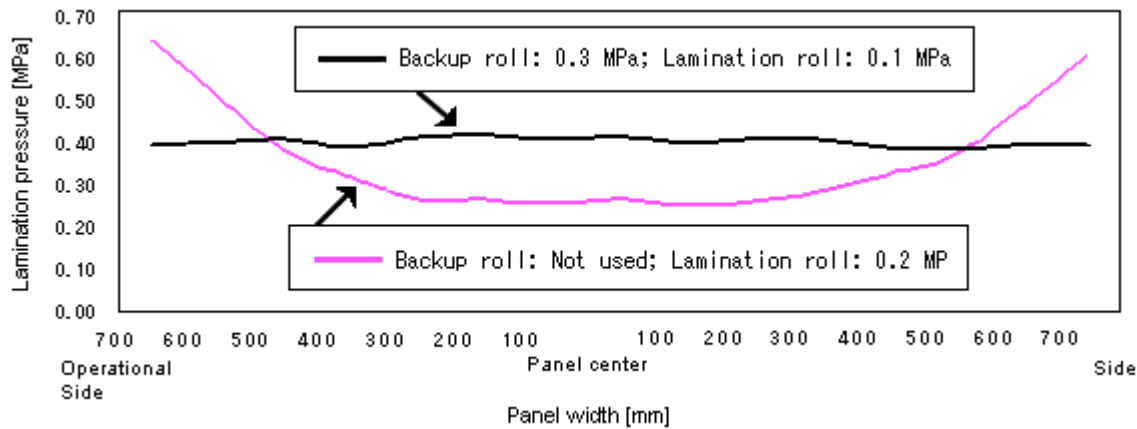


Figure 4 Comparison of Lamination Pressure Distributions

This figure compares the lamination pressures between the system equipped with backup rolls and the system free from backup rolls.

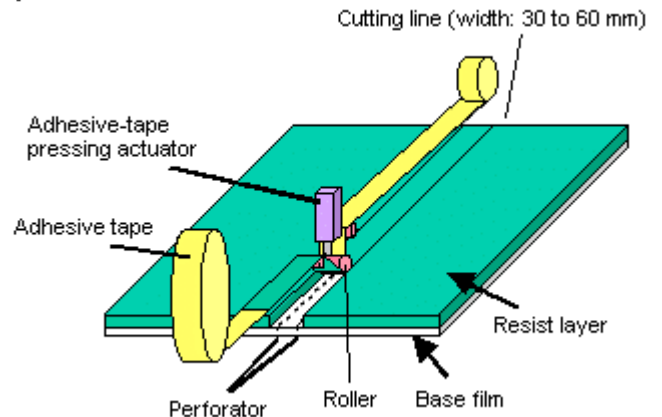


Figure 5 DFR Pretreatment Method

This figure shows the pretreatment of DFR to be laminated between the front and rear panels. The resist layer is removed and the base film perforated.

2.2 Major Specifications

Table 1 lists the major specifications of the PDP drycoater.

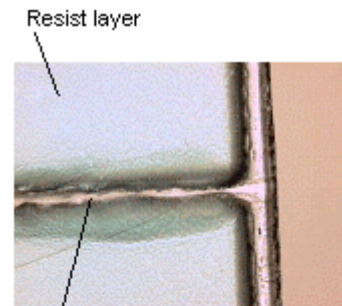
Table 1 Major Specifications of the PDP Drycoater

Item	Unit	Specifications
Panel dimensions	mm	The system is applicable to 1030 × 1460 both the longitudinal and lateral directions.
Panel thickness	mm	1.0–4.0
Lamination temperature	°C	60–150±3.5
Lamination speed	m/min	0.5–3.0
Lamination line pressure	N/cm	20–50

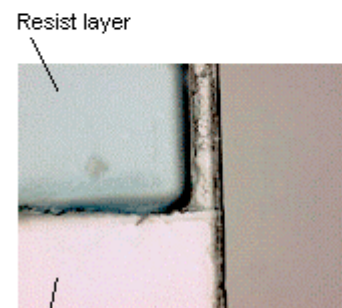
3 Pretreatment of DFR

When laminating the DFR onto the glass panel in the continuous mode, the film is not cut according to the panel length and tiling is therefore not achievable. For this reason, in the continuous film-lamination system of the PDP drycoater, the DFR is pretreated where it is laminated between the front and rear panels. In this pretreatment, only the resist layer of the DFR is peeled, and then the base film is perforated. In separating the resist layer, only the layer is cut using the disc cutter and removed using adhesive tape. Figure 5 outlines the pretreatment of DFR.

The blade end profile and pressing pressure of the resist cutter are optimized so that only the resist layer can be cut. Figure 6 shows pictures in which the DFR resist is cut and removed, respectively. We also developed a special adhesive tape for use in the removal of the resist-layer after being cut.



The resist layer is cut.
(a) The resist layer is cut.



Base film
(b) The resist layer is removed.

Figure 6 Pretreatment of DFR

The upper picture (a) shows the resist-layer after being cut and the lower picture (b) shows the DFR from which the resist layer is removed during the DFR pretreatment process..

4 Conclusion

The continuous film-lamination system developed for the PDP drycoater can be applied to printed wiring boards that require uniform film pressure due to their fine pattern design, in addition to the manufacture of larger PDF glass panels.

The achievement of higher throughput is the most important future task for coping with the expanded demand for PDPs.