TruNano™ processing of color photoresist for the flexible LCD module

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Abstract

We present a low temperature thermal process for the color photoresist on the flexible substrate for the LCD color filter module by the TruNano™ processor in combination with a compositional modification to the conventional color photoresist. By this method the curing temperature can be lowered by more than 100°C, and the curing process time also can be shortening by more than 20 min.

1. Objectives and Background

For the reduction of manufacturing cost, weight, thickness and durability of LCD panel, new manufacturing processes have been developed. One of the new processes given interest recently is lowering the processing temperatures of curing for the ink-jetted color filter for the flexible substrate or higher productivity. In this study TruNano™ processing [1] has applied for the development of the low temperature processing of the color photoresist on the flexible substrate for LCD panel.

The TruNano™ processing is a new method of firing/sintering/curing for a fabricating process for the flat panel display device. The characteristics of this method is the interaction (transmitted, absorbed, or reflected depending on the material type) with the processed materials and hence a selective energy application to the materials requiring the heat treatment at a molecular level not necessarily to be heated convectional heating method.

In this study a low temperature (~120°C) curing of the color photoresist on the flexible substrate by TruNano™ processing in combination with a compositional modification of the conventional color photoresist materials are conducted.

Small amount of chemical agent has been added into the commercial color photoresist as the curing-aid agent.

For the manufacturing of the FPD, numerous rapid thermal processing are required as in the baking, firing, sintering, and curing. Another characteristic of the TruNano™ processing is the rapid thermal processing in addition to the selective heating.

2. Results

The curing by self-heating TruNano™ method was conducted on the color photoresist on the flexible substrate. Three types of color photoresist (R, G, and B) are tested by this process: the conventional commercially available materials (~ 220 °C curing temperature) and the compositionally modified materials for the TruNano™ process.

Using the three types of materials, ink-jet printing was performed on the flexible substrate. The ink-jet printed substrates were heated at about 120°C for < 20 min by TruNano™ process.

Figure 1 shows the SEM micrographs of the cured color photoresist either on the glass substrate or flexible substrate.

The conventional color photoresist fired in the convectional RTP is shown in Fig. 1(a) while the modified paste cured by the TruNano™ process is in

Fig. 1 (b). The fractured surfaces in (a) and (b) show a dense and well-cured surface.

This results shows that the color photoresist can be cured by the TruNano™ process about 120°C in combination with the modification of composition in small amount.

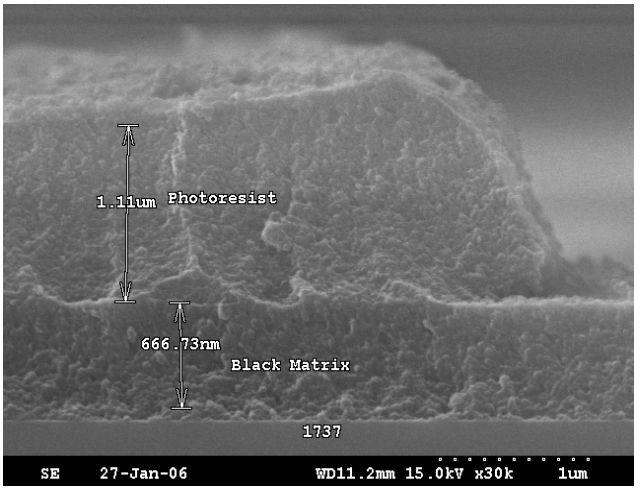

Fig. 1 (a) commercial color photoresist cured at 220°C for kept baking 40 ~ 60 min after 8 min ramp up (~25 Celsius/min) to 220 Celsius by convectional RTP

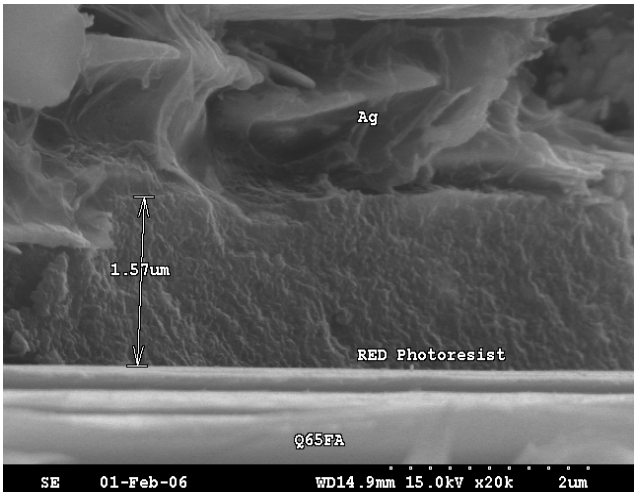

Fig. 1 (b) Modified color photresist cured at 120°C for 20 min after ramp up in < 5 min by TruNano™ process

3. Impact

The conventional color photoresist needs to be cured as high as 240°C. However, by using the TruNano™ process the curing temperature can be lowered by about 100°C in conjunction with a minor compositional modification.

We expect that, based on this a preliminary study, the processing temperature of the color photoresist on the color filter panel could be also reduced by more than 100°C by the TruNano™ process using the modified conventional photresists added with cur-aid agent. We will present the low temperature processing for the LCD module using the TruNano™ process, then light up.

4. Acknowledgements

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5. References

[1] Michael M. S. Lee, Eun Ha Choi, Phil Yong Oh, Kim Jung Seog, Cheol Hee Moon, Yong-tae Sul, Soon Bum Kwon, Soo-gil Kim, Hyonam Joo, and Jin Jang 'TruNanoTM Processing for Flexible Display' The 5th Flexible Display and Microelectronics, USDC, (2006)