Transparent Dielectric Layer for PDP by Dry Film Method

Lee Soon Park, Ho Chan Ji and Chang Beom Chung*
Department of Polymer Science, Kyungpook National University
***Kolon Central Research Park**
1370 Sankyuk-Dong, Buk-gu, Daegu, 702-701, South Korea,
Tel : +82-53-950-5627, Fax : +82-53-950-6616, E-mail : lspark@knu.ac.kr

Abstract

With a new PDP transparent dielectric layer formation technique, we were able to make dielectric layer with high transmittance by using dry film type dielectric material. We optimized dielectric pastes for dry film and they showed good process properties in lamination , drying and firing.

1. Introduction

In the manufacturing of plasma display panel(PDP), a dielectric layer is formed on both rear and front panel to protect address and bus electrode of PDP as shown Figure 1.

In the case of dielectric layer on the front panel high transmittance is required since the image is seen through the front panel of PDP. Currently the front panel dielectric layer of which thickness is about 40㎛ after sintering is fabricated by screen printing process which is repeated 5-7 times. Therefore a dry film type dielectric material which can be laminated is highly desirable from the viewpoint of reducing processing time. In this work we examined the basic formulation of dielectric paste, fabrication process of dry film utilizing the dielectric paste formulation, and the characterization of dielectric layer made by the dry film method

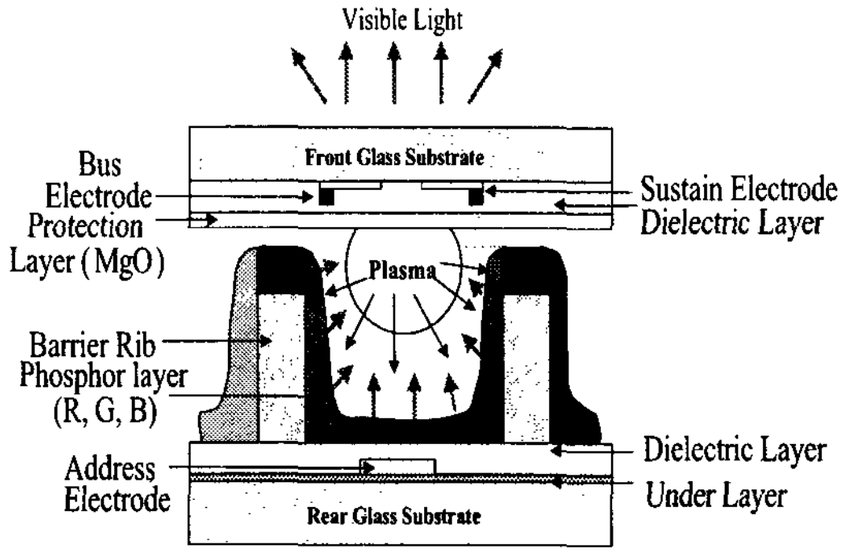


Figure 1. Structure of AC-PDP

2. Experimental

In order to get high transmittance of dielectric layer, binder polymer must be decomposed at relatively low temperature with no residue. In this study, poly(2-ethylhexylacrylate-co-methacrylic acid) and hydroxy propyl cellulose were blended to be used as binder polymer which could be burnt out at low temperature without residue.

We also have examined formulation of dielectric paste and fabrication of dielectirc dry film using the dielectric paste.

3. Results and Discussion

3.1 Formulation of Dielectric Paste

The components of dielectric paste were mixed with the aid of a mechanical stirrer and three roll mill (Exact Co., Germany). Cellulose type binder polymer (HPC, Aldrich Chemical Co., M_W 10,000) and acryl type binder polymer were blended in the menthanol solvent. Dispersant and leveling agent(Byk Chemie.Co.) were added to this solution and stirred for 2~3 hrs. To this solution(vehicle) was added dielectric powder and the whole mixture was stirred with a mechanical stirrer for 10-30 min. The slurry was then placed on the three roll mill and ground for 1-2 hrs until a homogeneous paste with desired rheological property was obtained. Table 1 shows several formulations of dielectric paste.

Table 1. Formulation of dielectric paste for dry film (unit : weight%)

No.	BP	HPC	menthanol	Inorganic powder	Dispersant	Leveling agent	Total
1	16	0	23.4	60	0.3	0.3	100
2	12.8	3.2	23.4	60	0.3	0.3	100
3	10	6	23.4	60	0.3	0.3	100
4	8	8	23.4	60	0.3	0.3	100

3.2 Fabrication of Dry Film using Dielectric Film Method.

For fabrication of dry film, dielectric paste was coated to about 70㎛ thickness on the poly(ethylene terephthalate)(PET) base film coated with release agent. This coated film was dried in the IR oven at 110℃ for several minutes and then covered with PET cover film by lamination. Figure 2 shows the fabrication process of dielectric dry film.

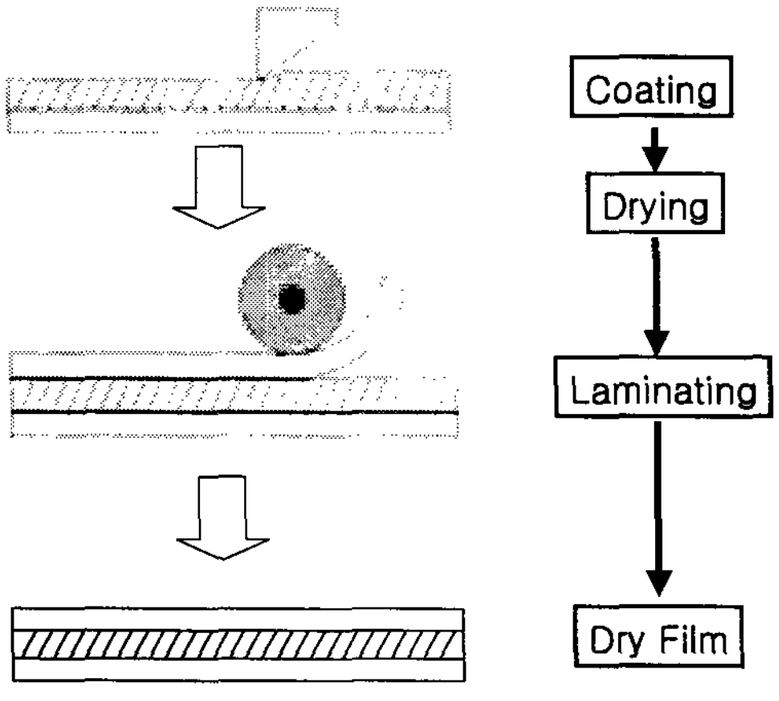


Figure 2. Fabrication of dielectric dry film.

3.3 Dielectric Layer Formation by using Dry Film Method.

Figure 3 shows the fabrication process of dielectric layer on the front panel of PDP. First, cover film was removed and the paste layer was laminated on front panel of PDP on which part of dielectric layer was formed by screen printing method. After lamination of dielectric layer the PET base film was peeled off. The dielectric layer was then fired at 540~570℃ for 30~40 min to give a sintered dielectric layer on the front panel of PDP.

Figure 4 shows thermal degradation properties of poly(EHA-co-MAA) and HPC blended binder polymer. The T_{id}(℃) of HPC was much lower than acrylate polymer and remained less residue was.

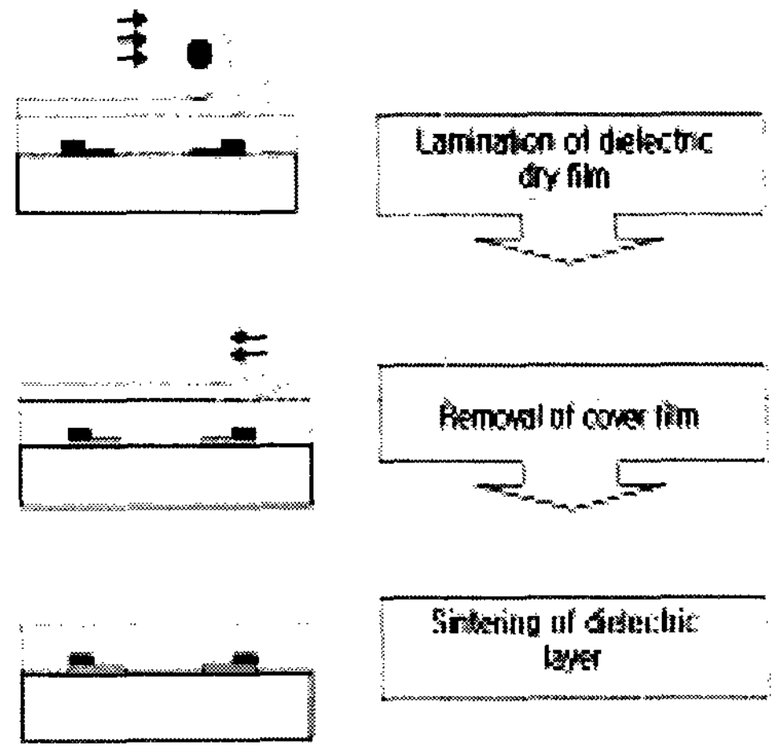
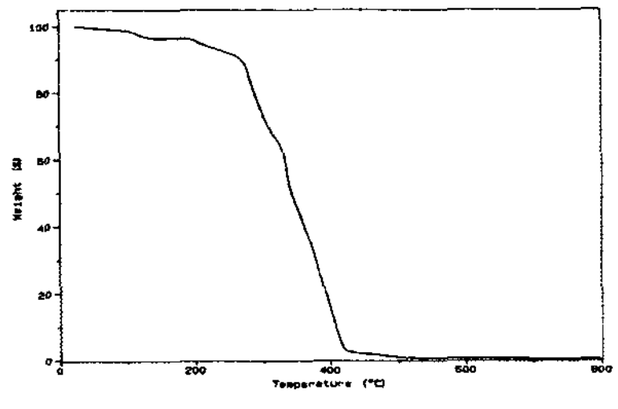
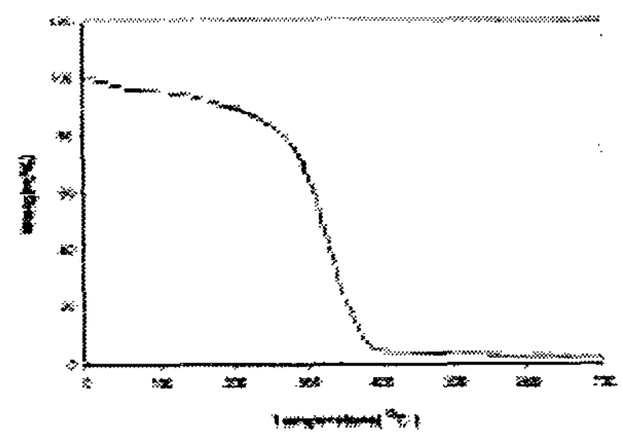


Figure 3. Fabrication process of dielectric layer on the front panel of PDP.



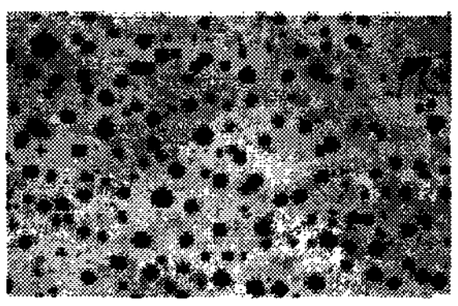
(a)



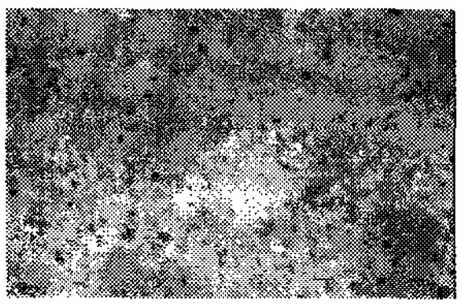
(b)

Figure 4. TGA thermogram of biner polymers (a) Poly(EHA-co-MAA) and (b) Poly(EHA-co-MAA)(60wt%) + HPC(40wt%)

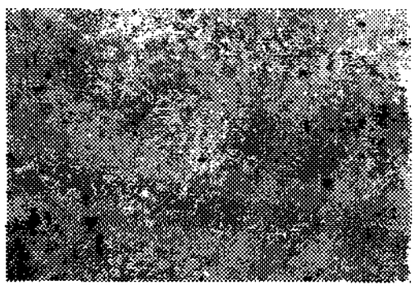
Figure 5 shows the morphology of sintered dielectric layers . As shown in Fig. 4 the micro foams in dielectric layer were decreased in the fabrication of dielectric dry film by incorporation of HPC as biner polymer in the dielectric paste formulation.



(a)



(b)



(c)

Figure 4. POM photographs of sintered *dielectric layer with HPC content in binder* polymer (a) 0wt%, (b)20wt% , (c)40wt%

For high transmittance of sintered dielectric layer, binder polymer must decompose before 400℃. The inorganic particles have softening temperature(T_s) about 400~450℃ and form inorganic surface layer, so over this temperature decomposed organic materials can not vaporize out and micro bubbles are formed finally. The light could be scatterd by these micro bubbles and transmittance of sintered dielectric layer was decreased.

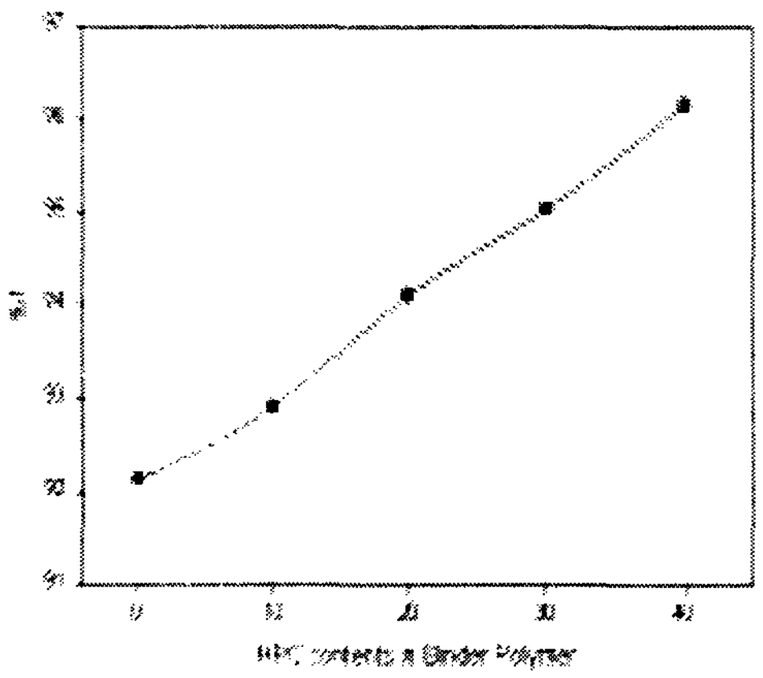


Fig 5. Transmittance of dielectric layer with HPC content.

Fig. 5 shows the transmittance of sintered dielectric layer. As shown in Fig. 5 the transmittance was increased by incorporation of HPC as biner polymer in the dielectric paste formulation.

4. Conclusion

The effect of dielectric paste formulation and the dry film process on the forming of dielectric layer on the front panel of PDPs was studied. Some important results are; (1) dielectric dry film can be formed to 70㎛ height by one time coating utilizing dielectric paste. (2) Dielectric layer was formed by lamination process using dielectric dry film. (3) As the content of HPC was increased in the dielectric paste, the transmittance of dielectric layer was increased after sintering. We hope that this technique will contribute to the low cost formation dielectric layer with high transmittance in the manufacturing of PDP.

5. Acknowledgement

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6. References

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