The effect of ink adhesion on color filter glass substrates by different plasma treatment

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Abstract

This study discussed the effect of ink adhesion on color filter glass after different kinds of plasma treatment. From contact angle analysis, we could get different ink adhesion results after HMDSZ, O_2, IPA, and CF_4 plasma treatment. Substrates after PFMCH plasma treatment have good surface hydrophobic property, and contact angle raise from <10^o to 50^o.

1. Introduction

It is the important component of liquid crystal display (LCD) to strain the slide (Color Filter) coloredly, only hinder through the red, green, and blue color pigment of coating, as the light source forms the red, green, blue light and mixes and forms the colored image in the human eye through straining the slide. If we want to utilize and gush out black technology to make colored while straining the slide, how to change the quality on the glass sill surface accurately to the black adhering to that dripped, it control it gush out it is the black it is black it is key technology among them in position that drip.

The surface changes the quality and activates treatment and can get the characteristics, such as homogeneity and functionality, etc. with the electric thick liquid in technology, rich industry using value. Activate treatment way and surface and take over one and get membrane characteristic made together well particularly by the electric thick liquid, with the electric thick liquid treated free radical or characteristic sense base that tries a slice of surface and forms, improve kissing the swimming skill of the glass sill, improve to the black adhering to that dripped of coloring further, the treatment that this research will change the quality through combining the electric thick liquid adds the yellow only little shadow technology method, or utilize electric thick liquid to change to deal with and match and connect a technology of getting together by channelling into and kissing the swimming skill clicking offering and gushing out the black law to strain the slide colored in quality, utilize this two kinds of methods to promote the adhering to to the coloring of glass sill.

This study focal point lies in finding out the suitable electric thick liquid and dealing with course and parameter, in the hope of promoting the glass sill and adhering to of the coloring , use to succeed in developing and utilizing gushing out black technology to prepare out the colored filter, can gush out in the black course the effective regular colouring to make , the waste of saving the colouring saves the cost and prevents from effectively because the colouring is spread and emerged and does not drip mixing blackly with the color, cause the color? Mix but form the bad product , and improve the good rate of the colored filter greatly.

2. Experimental

In other to control the wettability of RGB photo resist solution with substrate, we use low temperature plasma to modify hydrophobic or hydrophilic property of substrate surface in this study. Fig. 1 is the schematic diagram of plasma treatment reactor system. The power is RF power (Frequency: 13.56MHz). We could put into different gas or monomer, for example

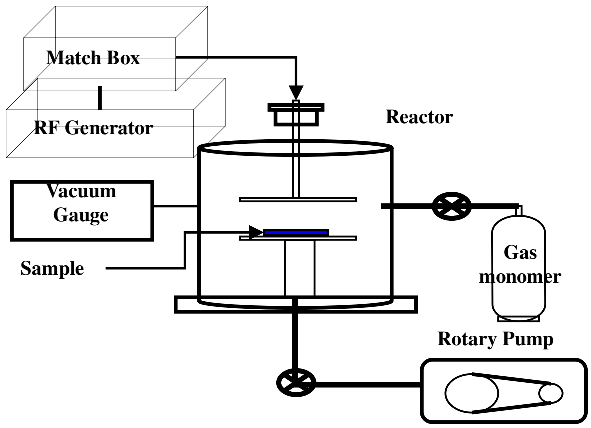


Fig. 1. Schematic diagram of plasma treatment reactor system.

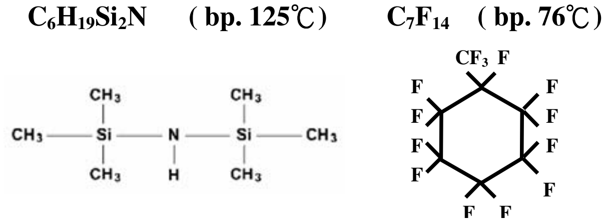
O_2, Ar, CF_4 etc., excited these monomer and gas to be plasma condition, and then modify materials surface. Fig. 2 shows the structural formula of monomer. Our substrates are glass and BM-glass (spin coating Black Matrix on glass) , and which size is 2 x 2 cm^2.

After plasma modification, we drop photo resist solution on sample and then observe the contact angle. For analysis the film we coating, this study use UV/Vis Spectrophotometer, Atomic Force Microscope (AFM) and FTIR to discussion.

3. Results and discussion

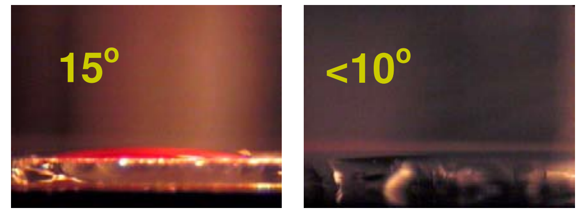
Fig. 3 shows the contact angle of glass and BM-glass. Untreated sample has low contact angle and good wettability whit photo resist solution. It means the top section of BM could not stop the moving of photo resist solution, and it is main reason of coloring of two photo resist.

$C_6H_{19}Si_2N$ (bp. 125℃) **C_7F_{14} (bp. 76℃)**



(HMDSZ) (PFMCH)

Fig. 2. Structural formula of monomer.



(a) glass (b) BM-glass

Fig. 3. Photo resist contact angle of untreated sample.

Table. 1 shows the contact angle of sample after different plasma treatment. It is interesting only plasma carried F element could make lower wsttablily of RGB photo resist solution. When we give hydrophilic functional group on surface, it would improve the photo resist solution adhesion of glass substrate. PFMCH plasma treatment would make glass and BM-glass low adhesion with photo resist solution, but CF_4 plasma treatment could make glass substrate more wsttablily with RGB photo resist solution and almost not affected the adhesion of BM-glass surface with RGB photo resist solution. BM-glass surface just has little lower wsttablily with RGB photo resist solution. In this way, we could know CF_4 plasma treatment may be a good plasma modification process for color filter substrate.

TABLE 1. Contact angle analysis of different plasma treatment

Substrate / Plasma	glass		BM	
	Water Contact angle	photo resist solution contact angle	Water Contact angle	photo resist solution contact angle
Untreated	**<20**	**18**	**80**	**<10**
CF4	**122**	**<10**	**20**	**28**
PFMCH	**106**	**40**	**110**	**46**
O2	**<10**	**23**	**<10**	**7**
HMDSZ	**98**	**22**	**104**	**10**

unit : degree (°)

- CF_4 : 200W、300mtorr、5min、20sccm
- PFMCH : 50W、50mtorr、1min
- O_2 : 50W、200mtorr、3min
- HMDSZ : 50W、50mtorr、5min

From Table. 1, it also shows PFMCH plasma treatment could make BM-glass have more high contact angle of RGB photo resist solution than CF_4 plasma treatment. So PFMCH plasma treatment process has the most effect to stop photo resist solution moving when ink-jet process making color filter. It is important to solve the photo resist solution adhesion of glass substrate after PFMCH plasma treatment.

In other to solve this question, we use second treatment process after PFHCH plasma treatment. We choose three process: O2 plasma treatment, UV-light irradiated and heat process. The result of the contact angle after second treatment is showed in Table. 2.

From Table. 2, the result shows second treatment of O_2 plasma treatment and UV-light irradiated could make substrate return good wettability with photo resist solution (contact angle <10^o) but heat process not.

TABLE 2. Contact angle after second treatment

		untreated	PFMCH (only)	Second treated O_2	Second treated UV	Second treated Heat
water	BM	80	112	20	48	114
	Glass	<20	108	<10	44	110
photo resist	BM	<10	54	<10	<10	52
	Glass	<10	50	10	<10	44

unit : degree (^{o})

- PFMCH: 50W. 50mtorr, 1min
- O_2 : 50W, 200mtorr, 3min
- UV: 1000W, 10min
- Heat: 100℃, 10min

We used UV-visible spectrum to discuss the light transmission percentage of color filter glass substrate after different kinds of plasma treatment. From Fig. 4, when the HMDSZ plasma treatment time increase, the light transmission percentage decrease. But the treatment time of O_2 plasma did not change light transmission percentage of color filter glass substrate (from Fig. 5).

If we use shortest plasma treatment time could improve the adhesion of color filter substrate, the coating film would not affect light transmission percentage.

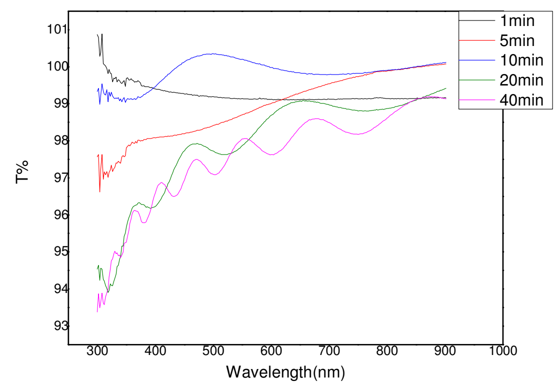


Fig. 4. UV-visible spectrum of HMDSZ plasma.

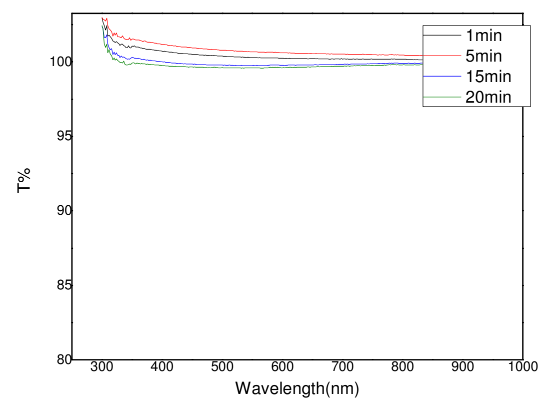


Fig. 5. UV-visible spectrum of O2 plasma.

4. Summary

When plasma modification treatment give surface hydrophilic groups, that is able to improve adhesion of ink on the color filter. Glasses and BM-glass after PFMCH plasma treatment have good surface hydrophobic property. Contact angle of photo resist solution on sample rises from <10^o to 50^o. And then sample after second treatment by O_2 plasma and UV-light irradiated could return wettability and adhesion of photo resist solution (contact angle <10^o).

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6. References

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