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The screen panel material for the future

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Abstract. Nowadays, the screen panel material used on TV, computers and smart phones are various and own different features. But in the future, will there be one material becoming the only choice under the development? In this research, the researcher shows the the current application condition of two main materials and give the forecast of the future.

Keywords: Liquid Crystal Display; Organic Light-Emitting Diode; Panel.

1. Introduction

With the development of science-technology, smartphone has been a necessary object that every one need to use during daily life. Nowadays, you may hear or notice some opinions from someone that in 2024, most of the phones look same. If it is about extrinsic feature, I agree on it. But if you mean the screen panel material, I have to say it is not true. Up till now, on every new smartphone launch event, the presenter still choose to spend a long time introducing the details and the data of the unique screen their product is equipped with.

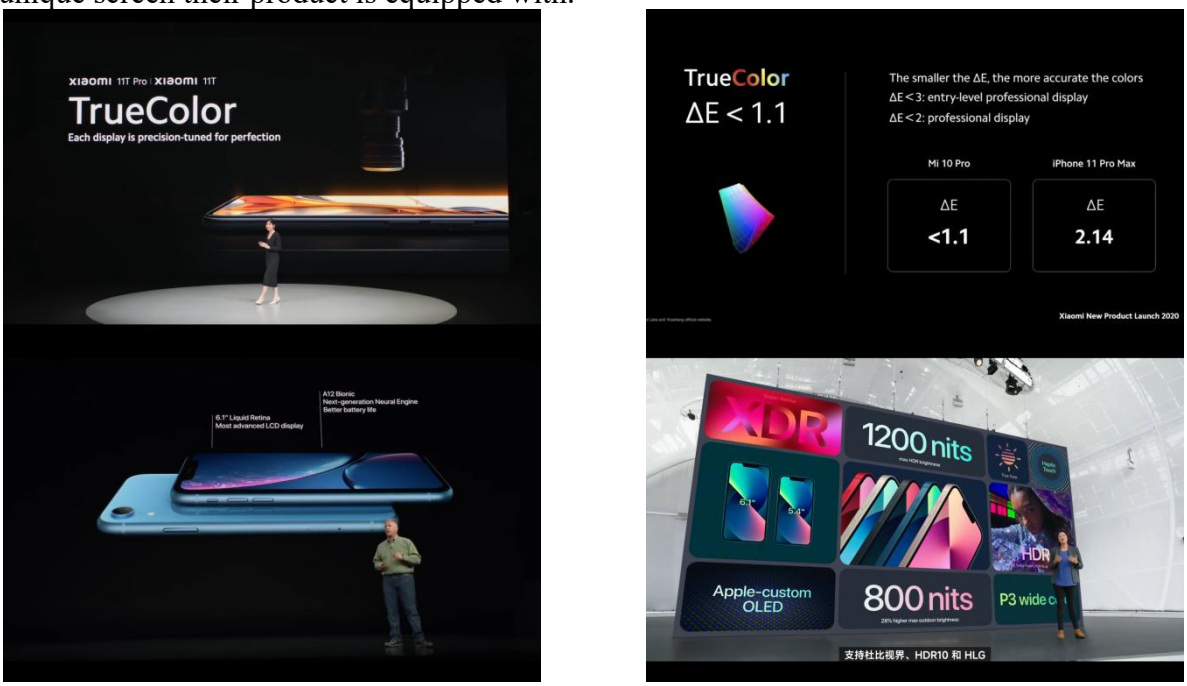

FIG. 1 These are the screenshots of new product launch events from Xiaomi and Apple

With the development of the panel industry, most kinds of the screen have experienced a large development over decades. Today, the colour accuracy of the OLED is getting better and better, and the brightness of the LCD panel can rise up to about 1000nit. At the same time,according to my research result, students in college will spend about 6 hours on their phone screen.

So, the first thing the future material needs to own is that it should protect our eyes from blue light and the users won't feel uncomfortable when they stare at the screen for several hours. Each of the screen materials is widely used by high-tech companies like Apple, Xiaomi, Samsung and so on today. But, which material will be the star of tomorrow, LCD or OLED? This paper will tell the difference and give you the answer.

2. Research context

According to Shi (2021), the visual fatigue caused by the bsLCD was the smallest compared with the normLCD and OLED. The slight shift of the blue light peak toward a longer wave-length reduced the S-cone and ipRGC illuminances, resulting in lower visual fatigue. “Generally, the visual fatigue caused by the bsLCD was the smallest compared with the normLCD and OLED. The slight shift of the blue light peak toward a longer wavelength reduced the S-cone and ipRGC illuminances, resulting in lower visual fatigue.” (Shi, 2021, p.11) . In a word, because of the good performance with low blue light, you can stare at the screen in a long time without feeling eye-dryed and visual fatigue. But now, many teams are aiming at a technology called DC dimming, which is used to restrain the flicker of the OLED screen in order to let the user feel more comfortable than before. The disappointing thing is that this technology is still not mature, and it may display some error line segments and colour faults.

According to Lee（2011），it shows the different structures between OLED and LCD, and tells the advantage of the OLED: Thinner and low power consumption.

Fig 2 The different structures of OLED and LCD

For LCD, when the resolution of the display screen becomes high resolution and large area, the proportion of LED light source passing through the panel will decrease, and it is necessary to make a large area surface light source. The power consumption will enlarge sharply and may cause some problems and disadvantages like low battery life, overheating... What is more, the paper mentioned the developing trend of touch technology. OLED can react more sensitively and faster than LCD. That means if your phone is using an OLED screen, you can enjoy a high-quality movie or have an extraordinary video game experience on your phone without visual fatigue.

Han and her team did an experiment to test the participants’ actual reflection on the different kinds of screen in different brightness. The stimuli in the experiment were 15 VR contents with different characters. Materials for smartphone and HMD viewing were selected considering the color, light, and details to fully investigate the difference that can be caused by the technological difference between OLED and LCD and the study participants’ perception of the display panel was surprisingly different between the HMD and smartphone contexts. They allow the participants to use words like brilliant, refreshing, comfortable and some other words to show their emotions in a much direct way. I think it can offer the real reflection from people in a direct but detailed way. The only disadvantage, in my opinion, the participants are 22 undergraduate and graduate students in their 20s to 30s (Han & Suk, 2019). Not only the number of people is small, but also they are all youngsters and if we need a general result, we should enlarge the range of age and do the experiment again. They got the conclusion that OLED screen looks more vivid and bright while LCD is considered dark and dull. Most participants prefer the OLED screen more.

Let’s come back to our topic: “The screen material for the future”. Not just for the present, but for the next generation. Han & Suk(2019) concluded that if the OLED is used on HMD, the display is

considered realistic and bright while the LCD display is considered dark and dull. Because of the meta universe, in the future, maybe the smart devices around you is not just only a smartphone. Smart watches, VR glasses will step into millions of families. Because OLED has the features like flexibility, high colour contrast, low visual fatigue and high brightness, it can offer the user a good experience and all these things can not be done well by LCD. That is the point making them different. And that is why OLED is called “Magic Display”. OLED industry will have a chance to develop and more tech-companies like Apple, Samsung, Xiaomi and so on will use them on different devices. That is exactly the material for the next generation! However, we should also take into consideration that there are still some difficulties that OLED should overcome in the future: OLED is prone to screen burn-in, but the LCD won’t have this annoying fact after a long-time use. Concerning about the life span of a smartphone, it will be an obstacle for the dissemination unless the producers solve the problem.

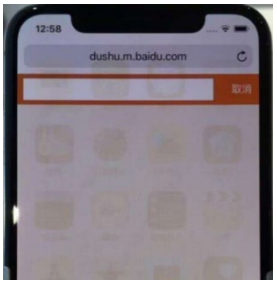

Fig 3 A screen which has burn-in with shadows in the white background

3. Conclusion

When we talk about the choice between the LCD or OLED, what we want is to look for a screen for the future, but not to criticize who is better. According to the different physical features between LCD and OLED, we can get to know that in some degree, OLED will be much suitable for the use in the future. It is not only just for the smartphones, but also for the smart devices like VR glasses and smart watches. At the same time, many smart phones companies like Xiaomi, Apple, Samsung, has begun to use professional devices to do some colour tuning for every phone just to make sure that any one of them can display the original colour. Another important thing is that if you want to use the under-screen finger print to unlock your phone, you must buy a flag-ship smartphone with OLED panel. From that point of view, it seems that OLED will be the star material for the future. But let we think in another direction, now LCD has a new kind of form: Mini-LCD. This technology can improve the display performance of LCD. But in this paper, I do not cite any material from that subject. So “who” will be the winner of the future? The answer should be given by the time and the history.

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