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Wrap-around Electrodes and Black Organic Layer for micro LED tiled displays

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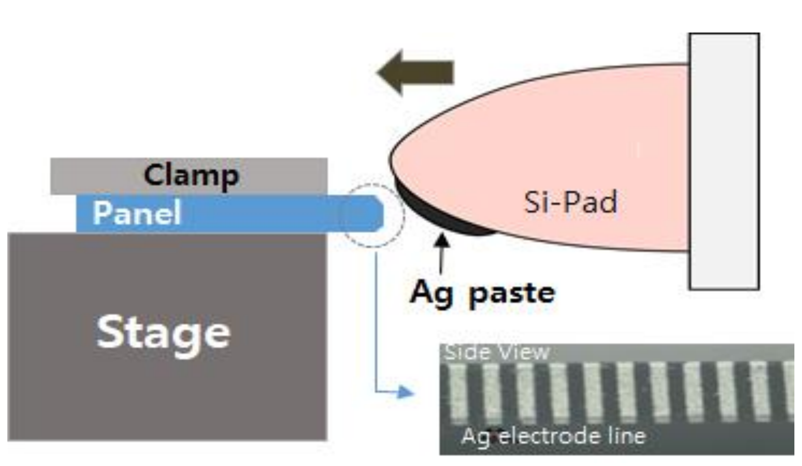
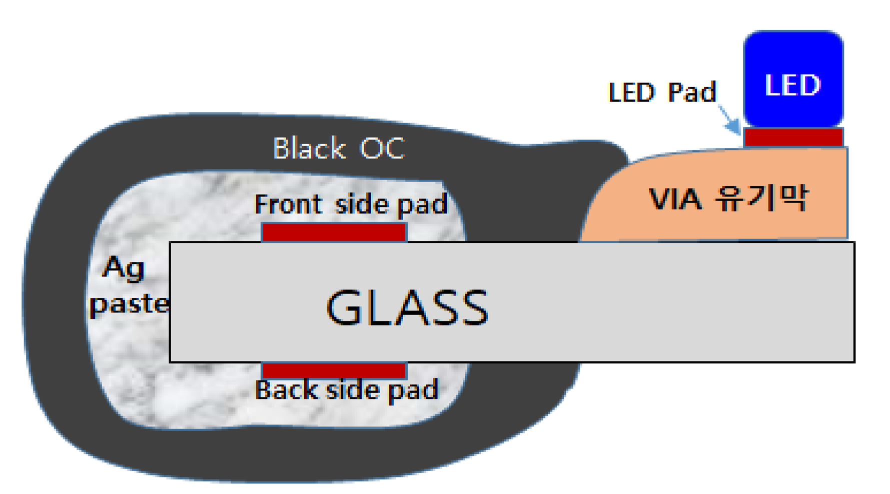
ABSTRACT

Recently, as large micro LED TVs of 100 inches or more have been released in the tiled display method, micro LED has been considered as a new display that goes beyond LCD and OLED TVs. In particular, in order to make the gap between panel and panel invisible in tiled display, wrap around side metal wiring technology and overcoating technology using black organic film that can reduce side metal reflection are very important. In this paper, Ag paste and the Black overcoating material technology and process technology were described on the glass side using the pad printing method that can form a film on the curved surface. In particular, the low-resistance side wiring sintering method using Ag paste and the development of Black OC materials that are robust to high temperature and high humidity reliability conditions have laid the foundation for making ultra-large TVs using micro LED tiled displays in the future.

What is the Wrap-Around Electrodes

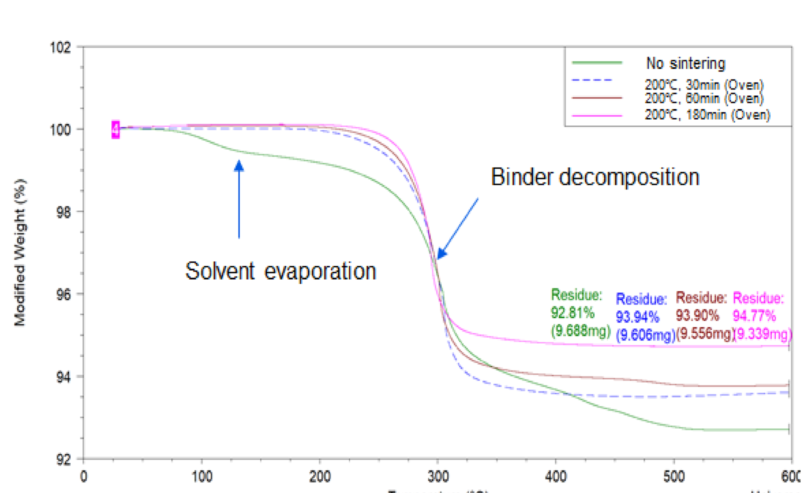


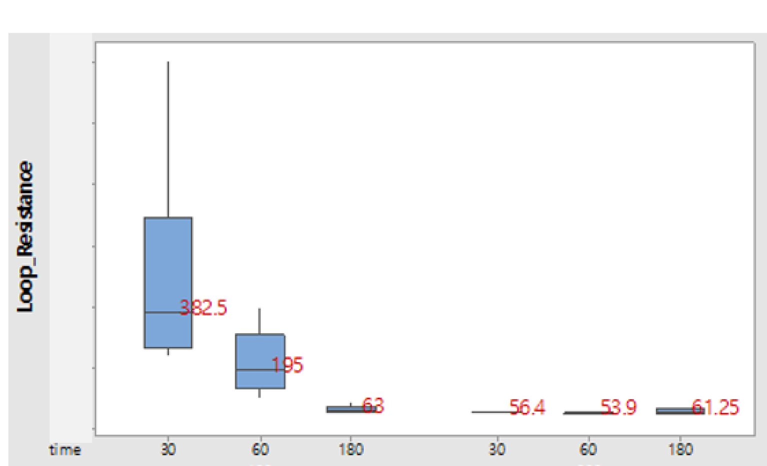
Sechematic of Pad Printing



Cross-section structure of Micro LED panel edge

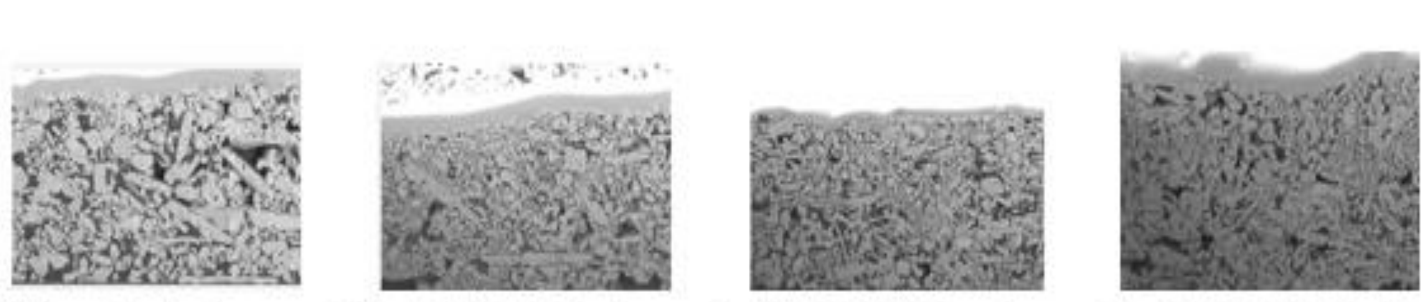
Ag Paste Sintering





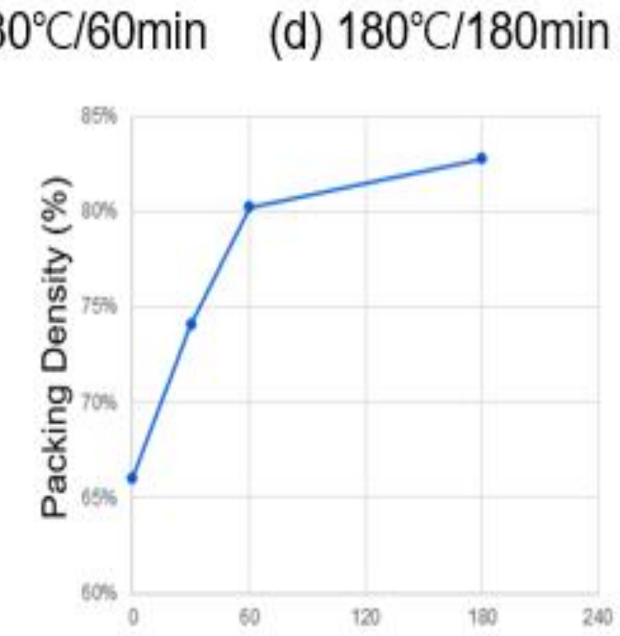
Figures show the loop resistance values according to the Ag paste sintering temperature and time, and it can be seen that the higher the packing density described above, the closer the Ag particles adhered and the lower the resistance.

Measurement of Packing Density of Ag



(a) No Sintering (b) 180℃/30min (c) 180℃/60min (d) 180℃/180min

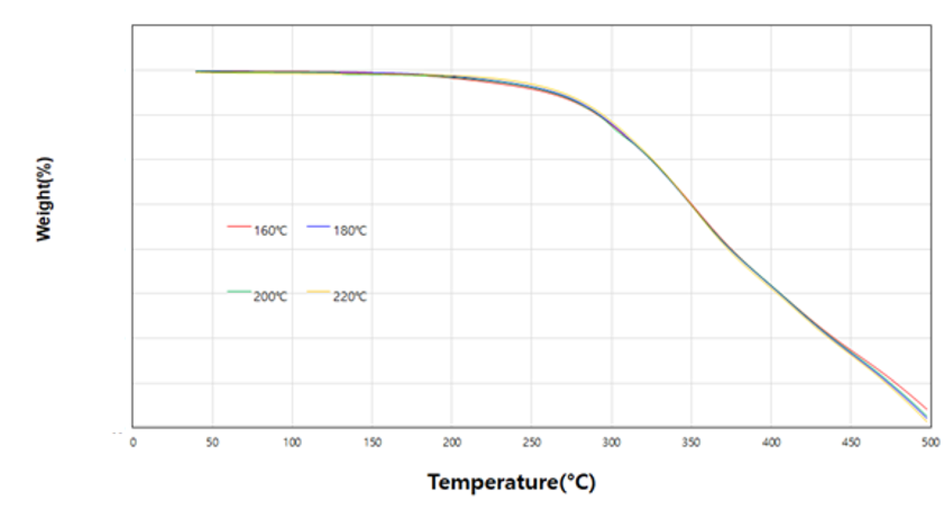
Packing density = Red ared / Box area

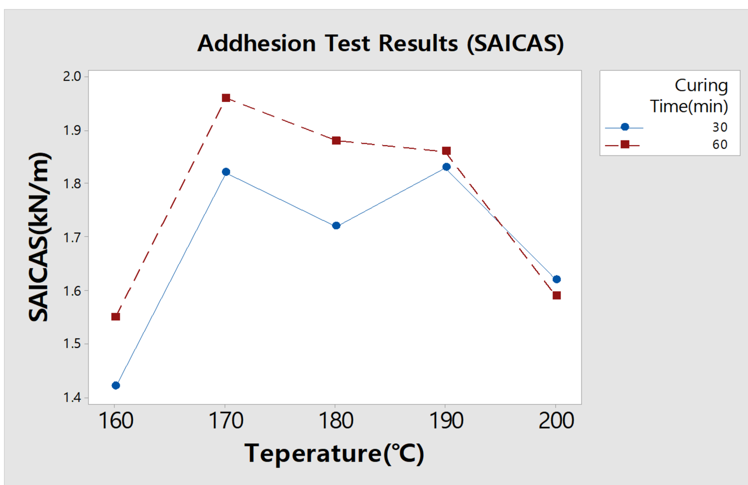


(f) Oven sintering time(min)

(a) ~ (d) of Figure 4 shows that Ag parcles are densely composed as the sintering time increases. To quantify this, the packing density was calculated through image processing, and (f) shows that the packing density increases with the sintering time.

Black Overcoating Materials



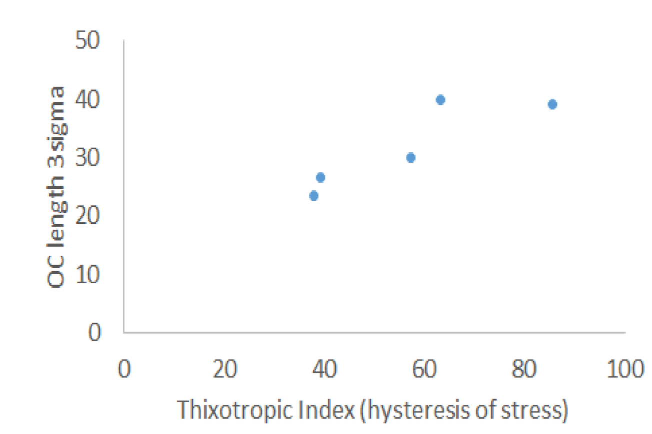


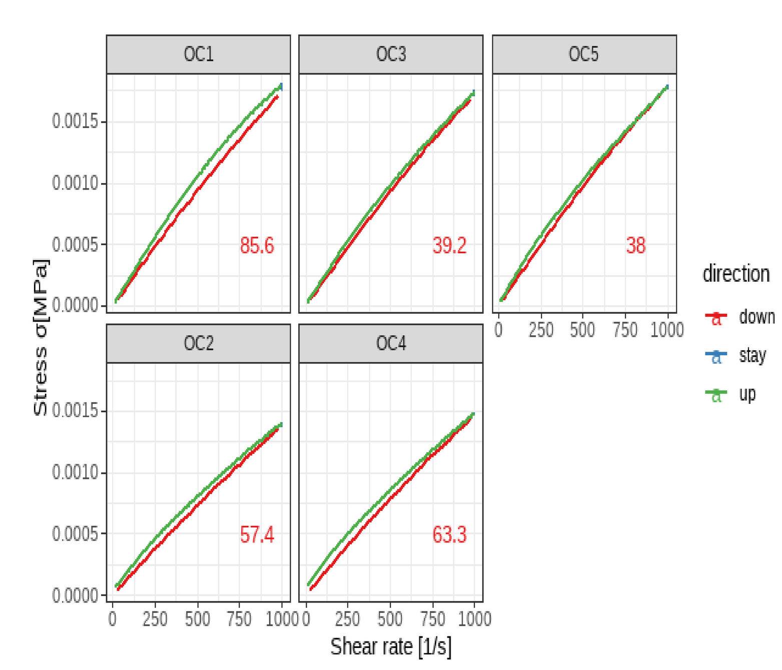
TGA data and Adhesion results (SAICAS) of OC material according to curing temperature

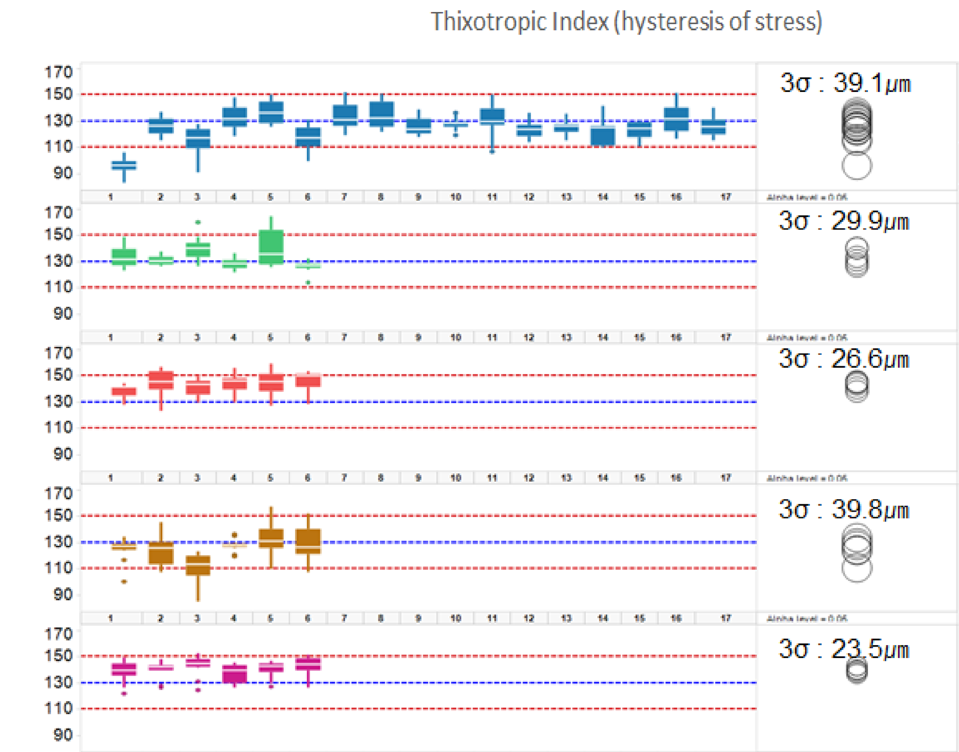
Relation between Thixotropic Index and Pad Printing Variation

Table 1. OC materials with 5 different compositions

Sample Number	filler size (μm)	hardener	solvent type	Storage Modulus(G')	vicosity [cp@Shear rate 10)	Thixotropic Index [Stress Hysteresis]	OC length [3σ)
OC_1	10	no	1 kind	4.7		85.6	39.0
OC_2	0.3	yes	1 kind	37.1		57.4	30.0
OC_3	0.3	no	1 kind	10.3		39.2	26.6
OC_4	0.3	yes	2 kinds	39.6		63.3	39.8
OC_5	0.3	no	2 kinds	15.1		38	23.5







Thixotropic properties can be inferred from several characteristic values, where a method of measuring stress values was used while increasing and decreasing the shear rate, and then hysteresis area was used as a substitute.

CONCLUSIONS

In this paper, we described the development of materials and process technology for forming the side wiring of Micro LED using Ag paste and Black OC pad printing method.. Through this research, we have newly developed the core technology and process technology of micro LED tiled display, wrap-around electrode and Black OC material. Through this, it is judged that there is a possibility of pioneering the ultra-large premium TV market of 100-inch or larger in the future.

References

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