Light Leakage Simulation of the Curved ADS LCD

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In previous paper [1], a curved ADS LCD panel was thought of as 3 optical uniaxial layer; an LC layer and two uniaxial layers which have a several optical retardation magitude and not uniformed axis distribution on panel. In the external bending force apply to LCD panel. The optic axis of the glass deviated from the horizental direction to oblique direction due to surounding sealant bonding, so initial light polarization easily leakaged at the 4edges location of panel between crossed polarizers. Different bending depth (curverture radius) and glass thickness were known as major factor to determine the light leakage by the the Ansys structure simulation and Jones's optic calculation processing [1].

Here, we investigated another the way how to reduce the light leakage by changing physical properties of the H & V panel widths, and H &V sealant's parameter through simulation processing, using the 27inch MNT panel size, 0.4mm glass thickness and normal ADS LC mode. Figure 1 shows the H :V width ratio splits (case #1; 4 :3, 16 :9, 25 :9) transmittance map. From this results, the larger is asymmetrical structure of the H: V width, the less light leakage exists. For case #2, H & V sealant's elastic constant was changed with reference 1.6Gpa and, case #3, only the H sealant's elastic constant was changed (V 's value was fixed), case#4, only V sealant's elastic constant was changed(H's value was fixed). From these results, the more soft is elastic properties of the horizontal sealant, the less light leakage exist.

For case #1, #2, #3, magitude and axis changing are similar contribute to changing of the transmittance. But, for case #4, light leakage and retardation are hardly improved.

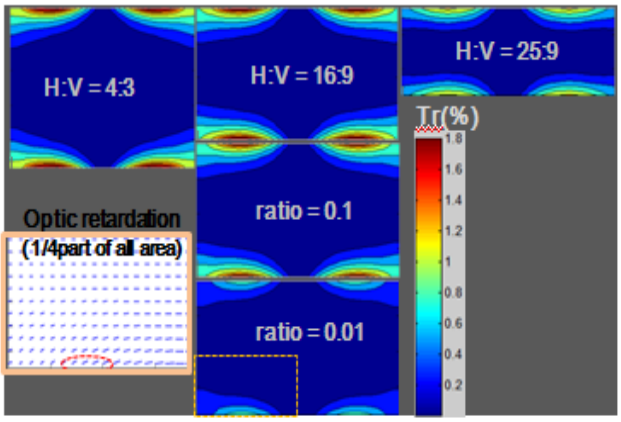

Fig. 1. Map of Tr data for split condition

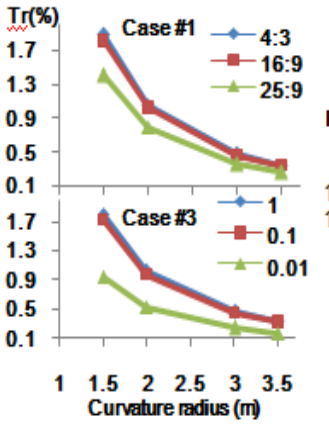

Fig. 2. Tr reducing for parameters

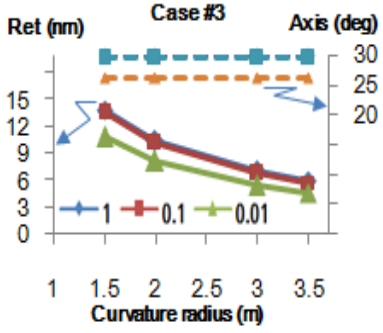

Fig. 3. Optic retardation results

Simulation data of the optical retardation magitude and axis was noticed in the Fig. 3, the magitude is very similar to calculating value by the the stress optic law of glass(stress_optic_constant *young module* $t^2/2R$). From this results, the geometric width of H&V ratio and the elastic properties of the horizontal side sealant are major contribution to location and strength of light leakage in the cureved ADS panel.

Table 1. Split condition and improvement result

Split #	#1	#2	#3	#4
	H:V width	H&V	H	V
Δparameter	H:V ratio 16:9→25:9	Seal elastic constant ratio 1→0.01		
ΔTr/Tr	-22%	-45%	-48%	+4%
Δret/ret	-9%	-18%	-23%	+4%
Δaxis/axis	-6%	-12%	-10%	-3%

References

1. J. You, W. Zhao, C. Jung, G. Qin, K. Kim, Y. Yang, Z. Wu, and X. Wang, *SID'15 Technical Digest*, No42-3 (2015).