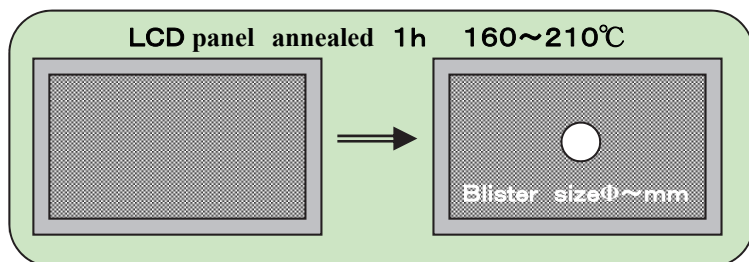


Characterization of the blister gas in the LCD panel by Raman Spectroscopy and TPD-MS

Blister generation of a LCD panel inside is one of the reasons of the indication deterioration. Raman spectrometry and TPD-MS can give information on the composition of the small blisters generated inside of the LCD panel.

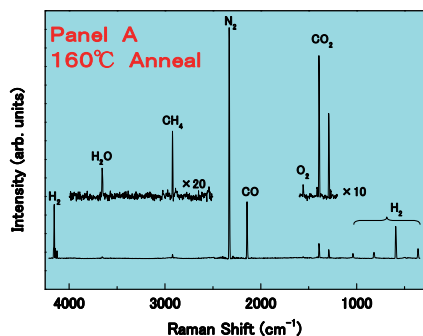


Cause for the blister generation of the LCD panel inside is considered to be release of the dissolved gases from each component by shock or heat loads. The composition of the blisters is greatly different depending on the structure of the panel and on the load condition. Therefore, the composition information becomes the important knowledge to clarify the source and the cause of the blister generation. Here, an example of the analysis of a commercial LCD panel annealed to create blisters forcibly. The temperature where blisters occur and the composition of the blisters are greatly different depending on a panel.

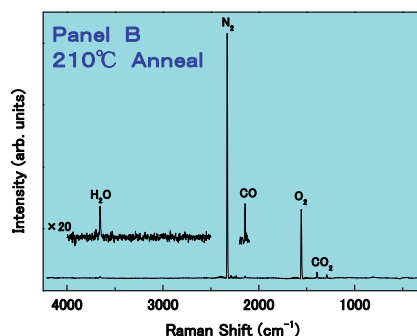
Raman Spectroscopy

Raman spectroscopy is potentially one of the most powerful techniques for characterization of a small amount of gas with the following features.

- It can obtain the only information on the blisters without the interference of the other element of the panel.
- It is possible to apply also to any panel shapes and small blister sizes (more than a size that can be watched).
- It is possible to apply to the characterization of blisters in other materials (resin and ceramics, etc).



$N_2 \rightarrow$ Adsorption of purge gas in the process
 $CO, H_2, CH_4 \rightarrow$ Resolution of organic compound

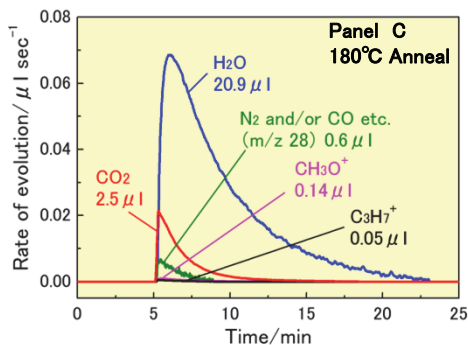


$N_2 : O_2 = 4 : 1$
 Generated near the sealing resin
 $\rightarrow$ Mixing of air due to degradation of resin

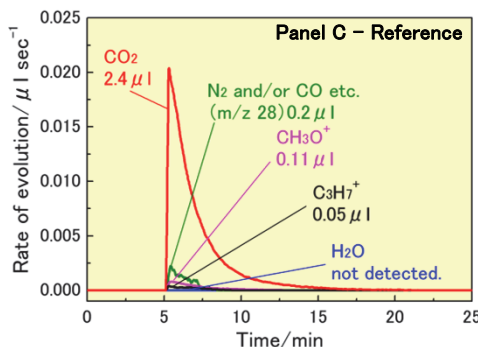
	Composition ratio (volume %)	
	Panel A	Panel B
CO_2	3.4 %	1.1 %
O_2	0.2 %	17.8 %
CO	16.8 %	0.5 %
N_2	71.9 %	80.3 %
CH_4	0.1 %	—
H_2O	0.2 %	0.3 %
H_2	7.3 %	—

TPD-MS

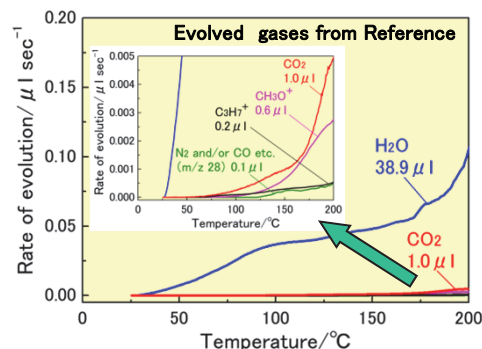
With using TPD-MS, it is possible to do qualitative and quantitative analysis of the ingredients in the blisters and the enclosure gas in the panel, by destroying the panel in an in-house airtight container, then introducing the released gases into high sensitivity mass spectrometer with carrier gas (He). The analysis under any desired temperature between room temperature and 100°C is possible. In addition, it has a possibility to identify an origin of the blisters generation with performing temperature programmed desorption analysis about each component.



H_2O and CO_2 were detected mainly, and also an unidentified fragment with $m/z=28$ and organic fragments (CH_3O^+ , $C_3H_7^+$) were detected in addition. The measurement was performed with an isothermal condition at 100°C.



By subtracting the results of an unannealed Panel from those of Panel C, the main ingredient in the blisters was identified as CO_2 and the organic ingredients were also found to exist significantly.



A tendency that the rate of evolution of the CO_2 increased above ca. 170 °C, close to the temperature where the blisters occur, was found, so the possibility that the CO_2 is the origin of the blister generation was suggested.