BANDO **Free Crystal**

Achievement of both Strong adhesion and Softness for the Optical Clear Adhesive (OCA) through innovative structural design.

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1.Background

Strong adhesion, softness, and excellent optical property are the key factors in achieving an excellent optical bonding result. However, it has been very difficult to simultaneously achieve strong adhesion and softness. Although some liquid type bonding materials (OCR) can have both properties, sheet type adhesives (OCA) have a strong demand due to the productivity, and the freedom of shape.

2. Purpose

In recent years, there are many changes in optical bonding trends such as screen size, lamination materials, and shapes. To satisfy these demands, we set out to design an OCA with excellent optical property, strong adhesion, and good softness.

3. Issues in conventional OCA

		Adhesion*	Hardness**
Competitors' OCA	Acrylic OCA	High (20.0N/25mm) Good	Hard (10.0-30.0) Bad
	Silicone OCA	Not strong enough (7N/25mm) Bad	Soft (0.5-2.0) Good

Fig.1
Difficulty to achieve both strong adhesion and softness.

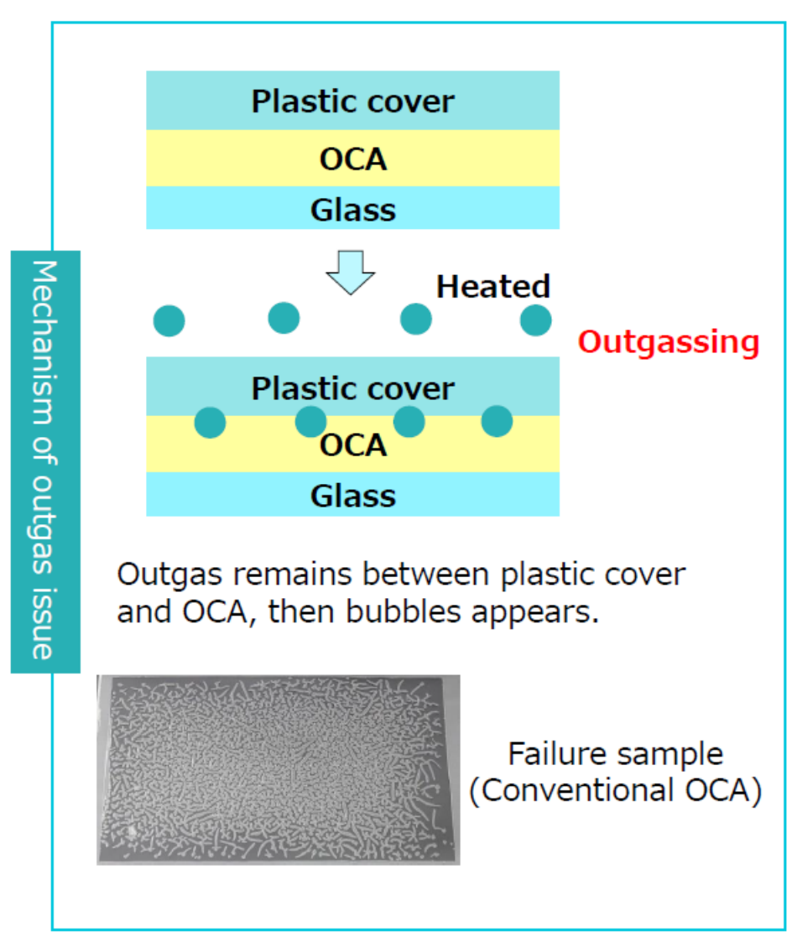


Fig.2
Lack of Adhesion

LCD MURA caused by Stress at Lamination, and/or from the warpage Of the cover plate.

Fig.3
Lack of Softness

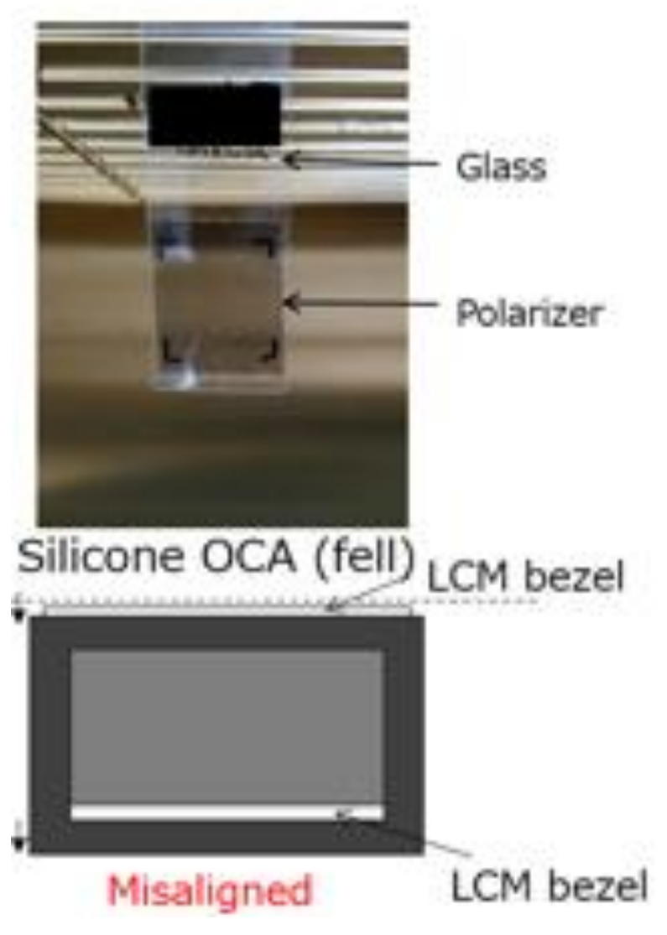
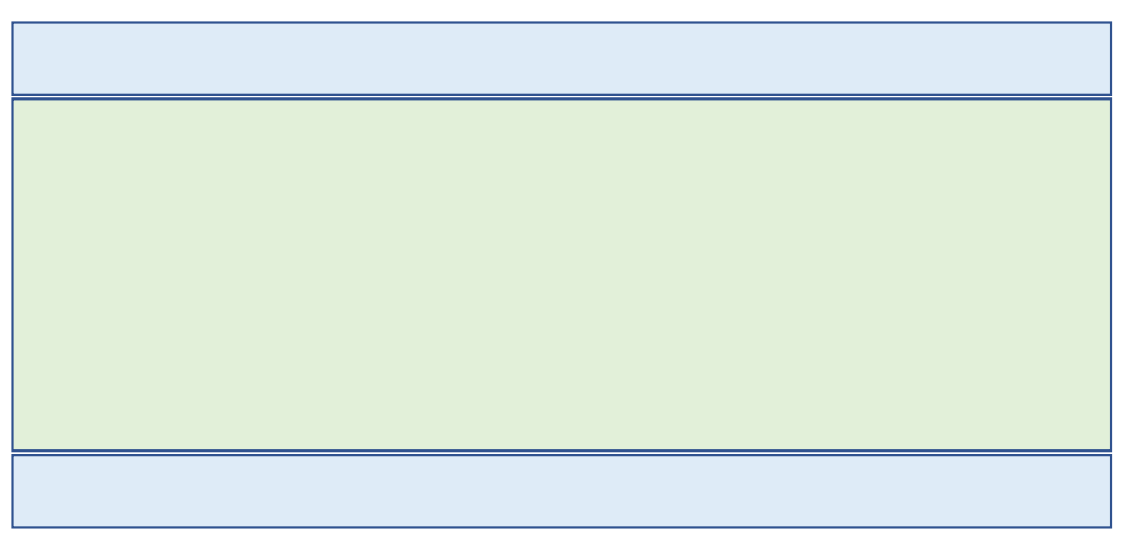


Fig.4
Lack of Shear Strength（Cohesion)

4. Our OCA's design concept (The separation of functions)



Strong adhesive layer
Soft Body（Controllable)
Strong adhesive layer

Fig.5 Cross section Structure　※Patented

We achieved both strong adhesion and good softness through innovative structural design.
While the surface layer keeps strong adhesion,
We can control the softness（cohesion) of body.

5. Result

Strong adhesion protects against bubbles from outgas, and delamination. The soft body eases stress and avoids MURA from unevenness of laminated materials, printing gap, and expansion and shrinkage of laminated materials.

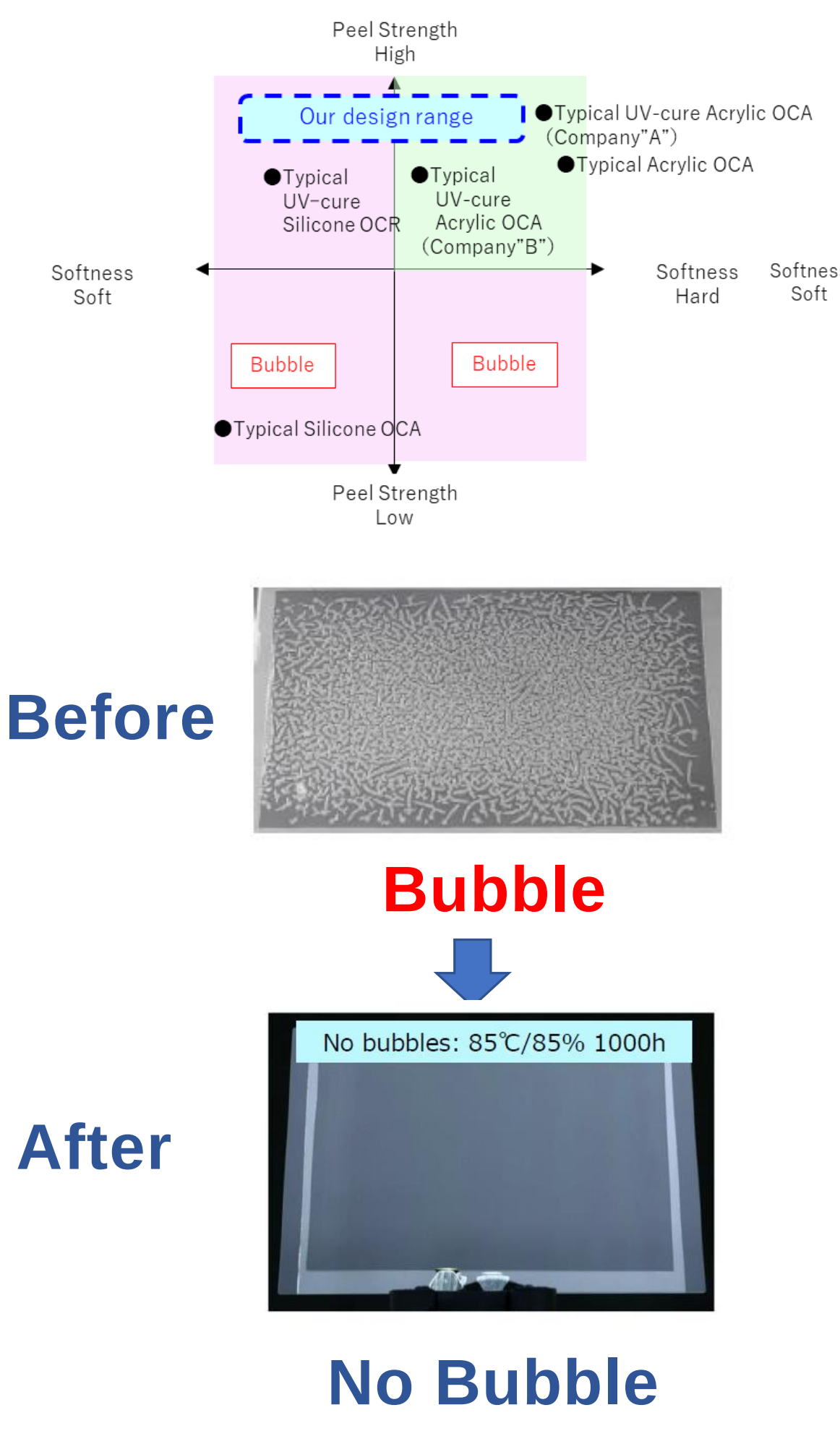


Fig.6
Optimization for bubbles by outgas.

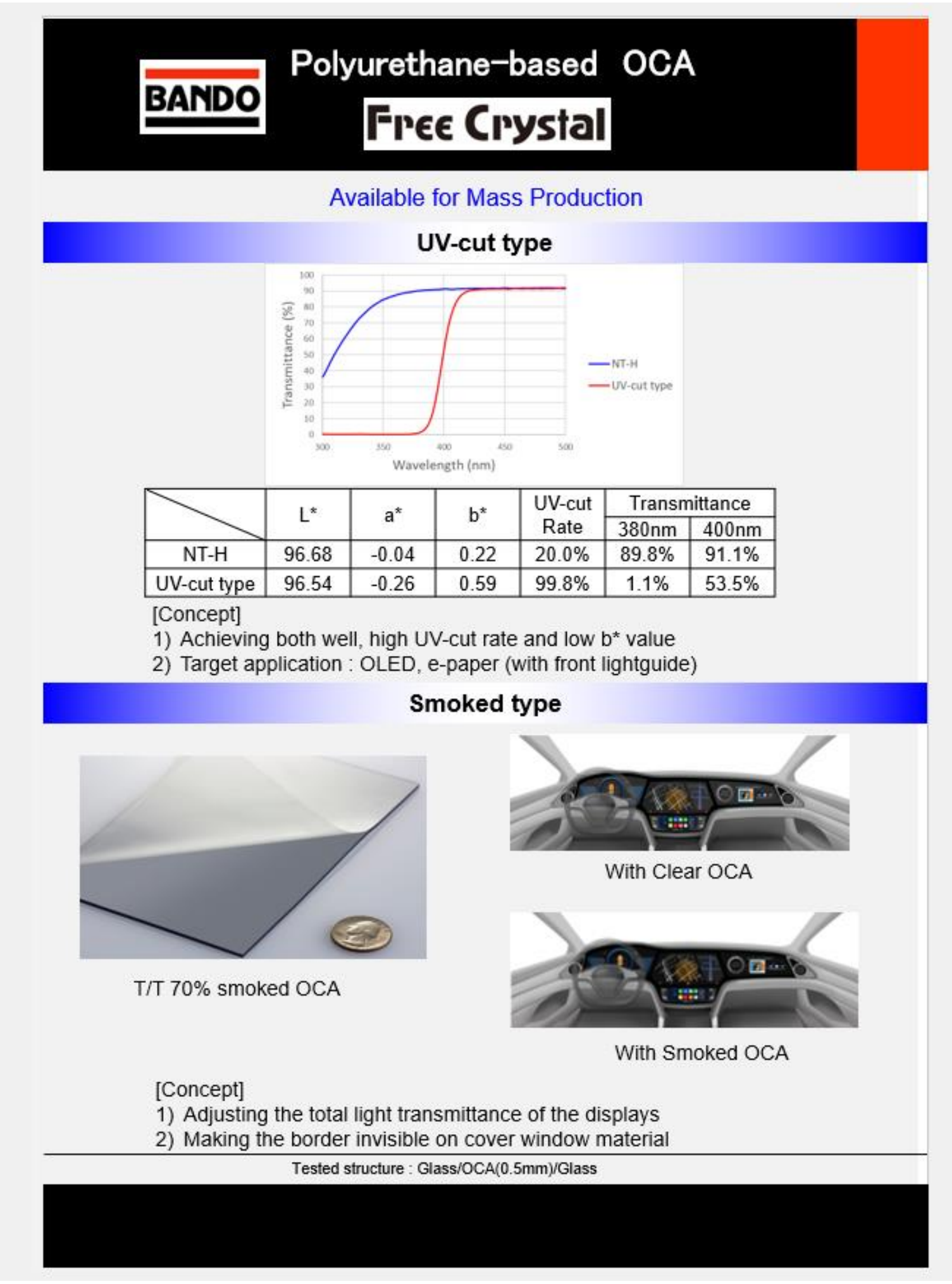
Fig.7
Optimization for LCD MURA

Fig.8
Optimization for delamination and MURA for curved lamination.

6. Conclusion

Our new OCA is optimally designed for multi-purpose laminating including flat, curved, large size, and plastic cover lamination by achieving both strong adhesion and balanced softness.
With excellent optical property, our line of OCAs are widely used in mass production in Automotive and Industrial display markets.

7. Further development with this concept (New lineups)



BANDO Polyurethane-based OCA **Free Crystal**

Available for Mass Production

UV-cut type

	L*	a*	b*	UV-cut Rate	Transmittance 380nm	Transmittance 400nm
NT-H	96.68	-0.04	0.22	20.0%	89.8%	91.1%
UV-cut type	96.54	-0.26	0.59	99.8%	1.1%	53.5%

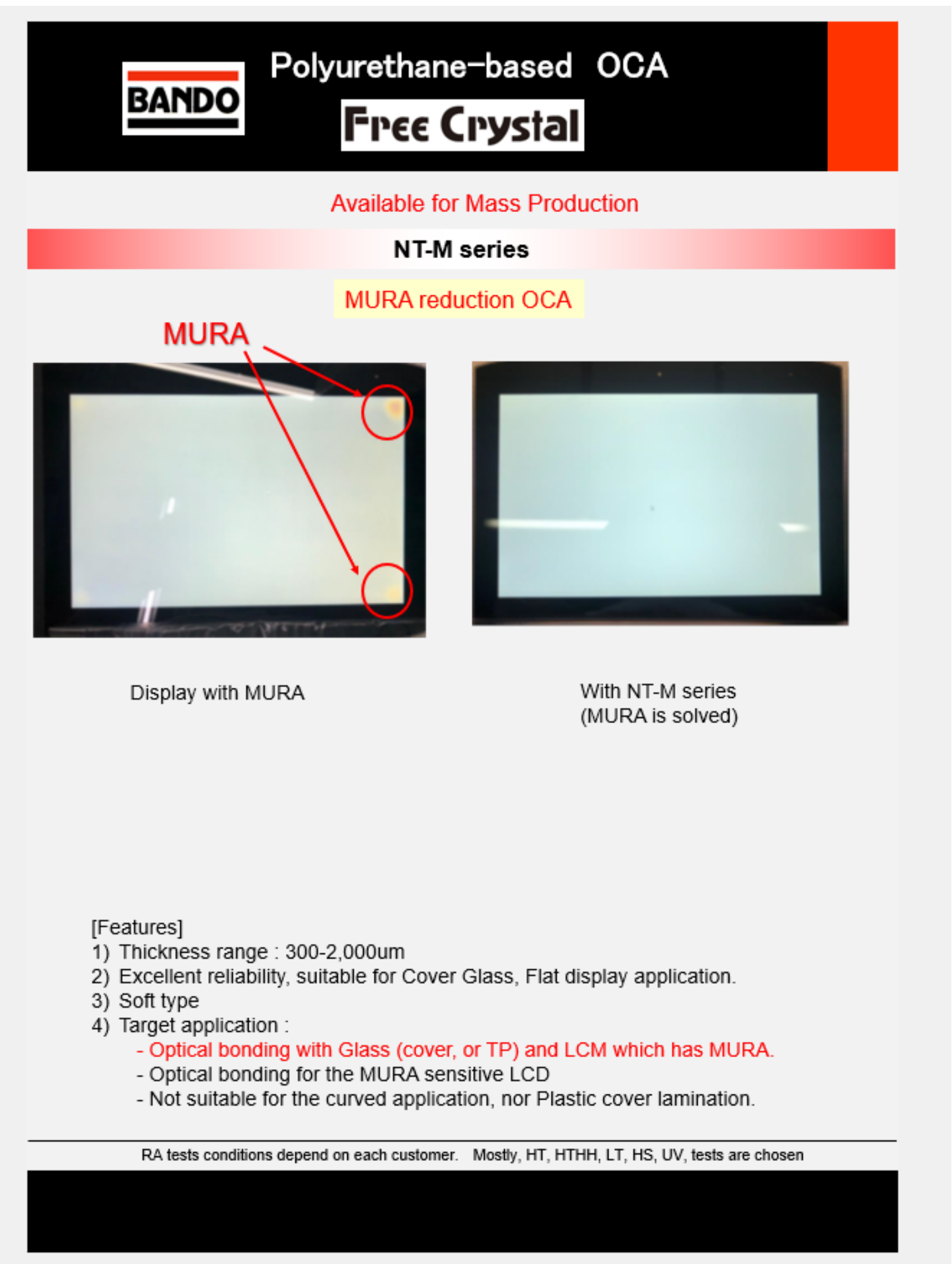
[Concept]
1) Achieving both well, high UV-cut rate and low b* value
2) Target application : OLED, e-paper (with front lightguide)

Smoked type

T/T 70% smoked OCA
With Clear OCA
With Smoked OCA

[Concept]
1) Adjusting the total light transmittance of the displays
2) Making the border invisible on cover window material

Tested structure : Glass/OCA(0.5mm)/Glass



BANDO Polyurethane-based OCA **Free Crystal**

Available for Mass Production

NT-M series

MURA reduction OCA

Display with MURA
With NT-M series (MURA is solved)

[Features]
1) Thickness range : 300-2,000um
2) Excellent reliability, suitable for Cover Glass, Flat display application.
3) Soft type
4) Target application :
  - Optical bonding with Glass (cover, or TP) and LCM which has MURA.
  - Optical bonding for the MURA sensitive LCD
  - Not suitable for the curved application, nor Plastic cover lamination.

RA tests conditions depend on each customer.　Mostly, HT, HTHH, LT, HS, UV, tests are chosen

OCA (Optical Bonding Material)

BANDO

Free Crystal® NT Series

✓Super thick
300 – 2000um available

✓High Reliability
Suitable for Automotive, Avionics, Marine, and other rugged display application