Osaka-CLBO™

$CsLiB_6O_{10}$ (CLBO)
Discovered by Osaka University in 1993

A nonlinear optical crystal Cesium Lithium Borate Crystal $CsLiB_6O_{10}$ (CLBO) has a wide transparent wavelength region (2.7μm to 180nm) and birefringence suitable for the generation of deep-ultraviolet radiations such as 266nm, 213nm, and 193nm. CLBO has already been put to practical use in several coherent DUV sources for semiconductor inspection applications. Precise processing, such as drilling in printed circuit boards, requires high-average DUV sources operated at a kilohertz repetition rate. Osaka University and SOSHO CHOKO have newly developed high-quality CLBO (Osaka-CLBO™) for high-power DUV users.

Material	$CsLiB_6O_{10}$
Main Application	266nm DUV light generation
Crystal Angle (deg)	θ=61.9±0.25, ϕ=45±0.5
Size (mm)	5×5×10, 5×5×15
Size Tolerance	W±0.1 × H±0.1 × L±0.2
Clear Aperture (mm)	Central 80% of the diameter
Transmitted Wavefront, PV (λ)	≦1/8 @λ=633nm
Flatness, PV (λ)	≦1/4 @λ=633nm
Surface Quality	S/D=10/5
Chamfer (mm)	≦0.2mm
Chipping (mm)	≦0.1mm
Other Applications	355nm, 213nm, 193nm UV light generations

SOSHO CHOKO
Osaka-CLBO™

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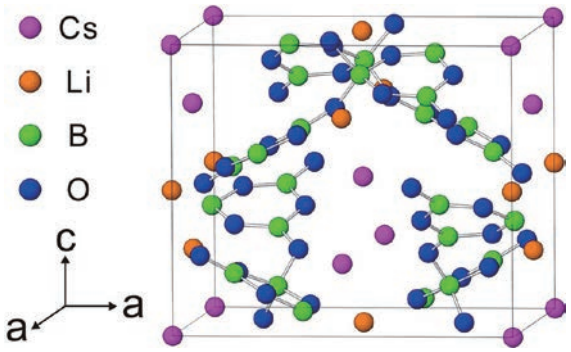
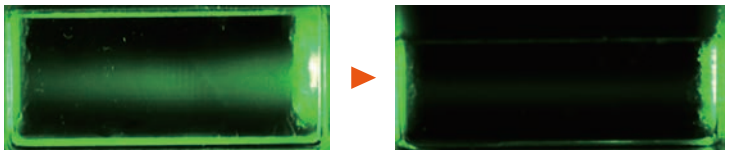


Tetragonal, Point group -42m

d_{36}(532nm)=0.92pm/V, d_{36}(1064nm)=0.74pm/V
J. Opt. Soc. Am. B, Vol.18, p.302 (2001)

Shortest SHG wavelengths: 236.5nm(type1), 318nm(type2)
OSA TOPS ASSL, Vol.26 p.715-719 (1999)

Observation of light scattering in CLBO



Conventional CLBO

Osaka-CLBO™
Newly developed CLBO
by Osaka University

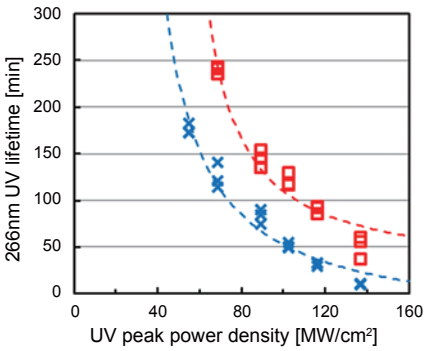
Advantages

- **Large Nonlinearity**
- **Small Walk-off Angle**
- **Broad Angular, Spectral and Temperature Acceptance Bandwidths**

Suitable for high-power DUV light generation (266nm, 213nm and 193nm DUV light generations have been already achieved)
Chen and Sasaki et al., Nonlinear Optical Borate Crystals, Wiley (2012)

New application of 355nm high-power UV light generation
Opt. Express Vol.24, p.30465 (2016)

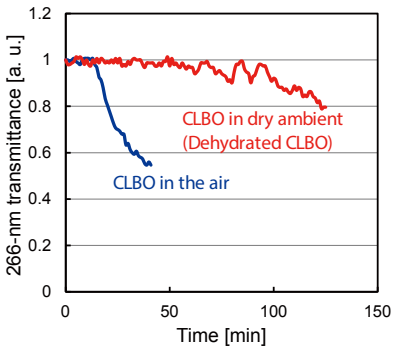
Long lifetime and high laser-induced damage tolerance than conventional CLBO



Opt. Mater. Express Vol.4, p.559 (2014)

□ **High-quality CLBO**
× **Conventional CLBO**

Dehydrated CLBO at 150°C has higher laser-induced damage tolerance

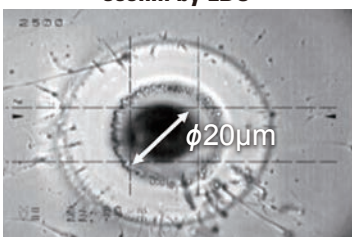


Dehydration process of CLBO
Appl. Opt. Vol.48, p.1658 (2009)

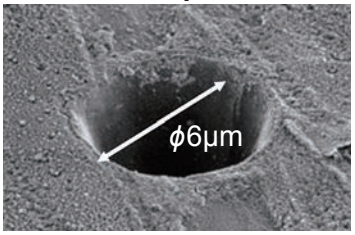
Patents Licensed from Osaka Univ. & Mitsubishi Electric Co.
JP : 4911494 **US :** 7,948,673
CN: ZL200780006027.X **TW:** I408482

Micro-hole drilling on borosilicate glass substrates by Mitsubishi Electric Co.

355nm by LBO



266nm by CLBO



SOSHO CHOKO
Osaka-CLBO™

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