CPD4-1

200mW 192nm Generation using $CsLiB_6O_{10}$ Crystal

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(Abstract)
More than 200mW average power at 192nm was obtained at repetition frequency of 100Hz using CLBO as the final sum ferequency mixing crystal. In the operation of 10Hz 3.8mJ/pulse at 192nm was obtained.

CPD4-2

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(Summary)

More than 200mW average power at 192nm was obtained at repetition frequency of 100Hz using CLBO as the final sum ferequency mixing crystal. ln the final mixing stage 1.96 μm output of the OPO was mixed with the fifth harmonic output of Nd:YAG Iaser as shown in Fig.1.The second, fourth, and fifth harmonics of Nd:YAG Iaser was generated by BBO, CLBO, CLBO, respectively. As the Nd:YAG fundamental laser has a top-hat beam , relay imaging was used to suppress the phase distortion of the beam as small as possible.

In the operation of 10Hz 3.8mJ/pulse at 192nm was obtained as shown in Fig.2(a). However this 192nm output energy decreased to 2.1mJ/pulse at re-petition of 100Hz as shown in Fig.2(b) probably because of increasing thermal dephasings at high repetition in each crystal, especially in the final mixing , 4HG and 5HG crystals.The overall conversion efficiency(fundamental to 192nm energy) was 1.5% and 0.85% at 10Hz and at 100Hz, respectively.

The performance comparison between CLBO(Type2) and LBO(Type1) in the final SFM stage was also experimented. As a result CLBO generated larger power than LBO at both 10Hz and 100Hz operation frequencies. Taking into account the relatively larger effective nonlinear optical coefficient and the acceptance temperature band width of CLBO than LBO, this result is reasonable.

CPD4-3

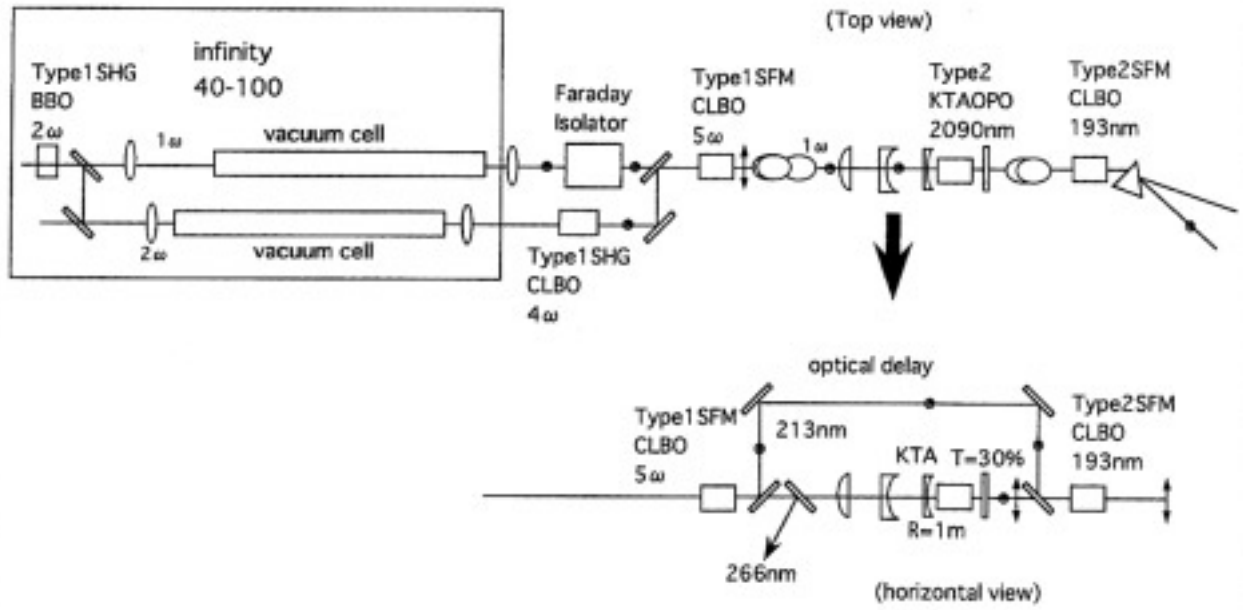


Fig.1 Schematic of 192nm generation.

CPD4-4

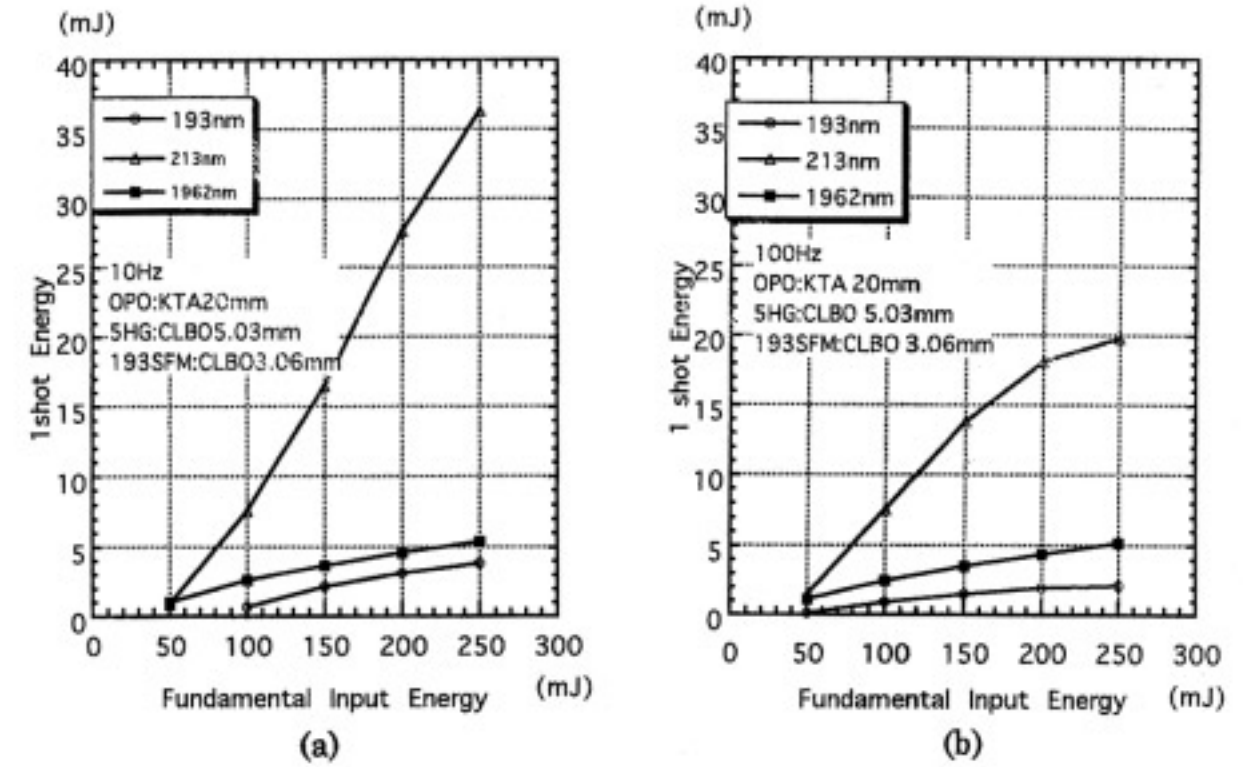


Fig.2 (a) Fundamental input energy versus SFM and Harmonic output energy at repetition of 10Hz. (b)Fundamental input energy versus SFM and Harmonic output energy at repetition of 100Hz.

参考資料

Introduction

・$CsLiB_6O_{10}$(CLBO) is a powerfui nonlinear crystal for UV coherent light generation.

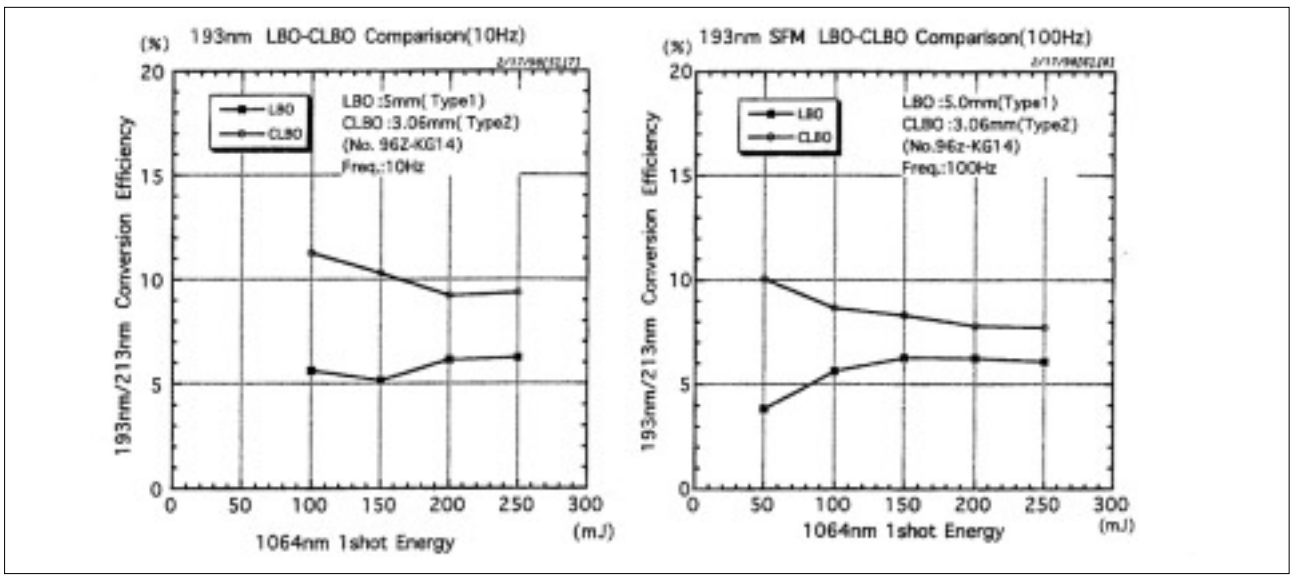
・Using CLBO we obtained
Nd:YAG 4th harmonics : 10W,
Nd:YAG 5th harmonics : 4W,

・Using CLBO as the final mixing crystal
we experimented 192nm generation
OPO 2μm+Nd:YAG 5th harmonic

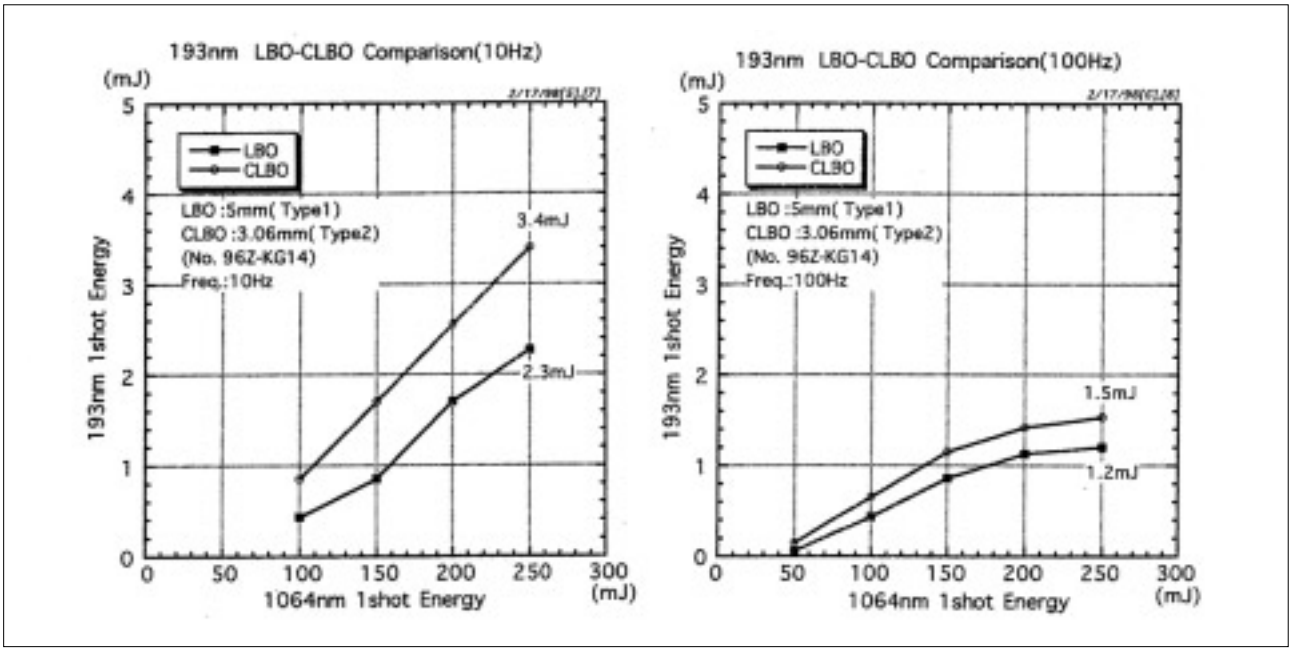
・The efficiency comparison CLBO vs. LBO in the final SFM stage

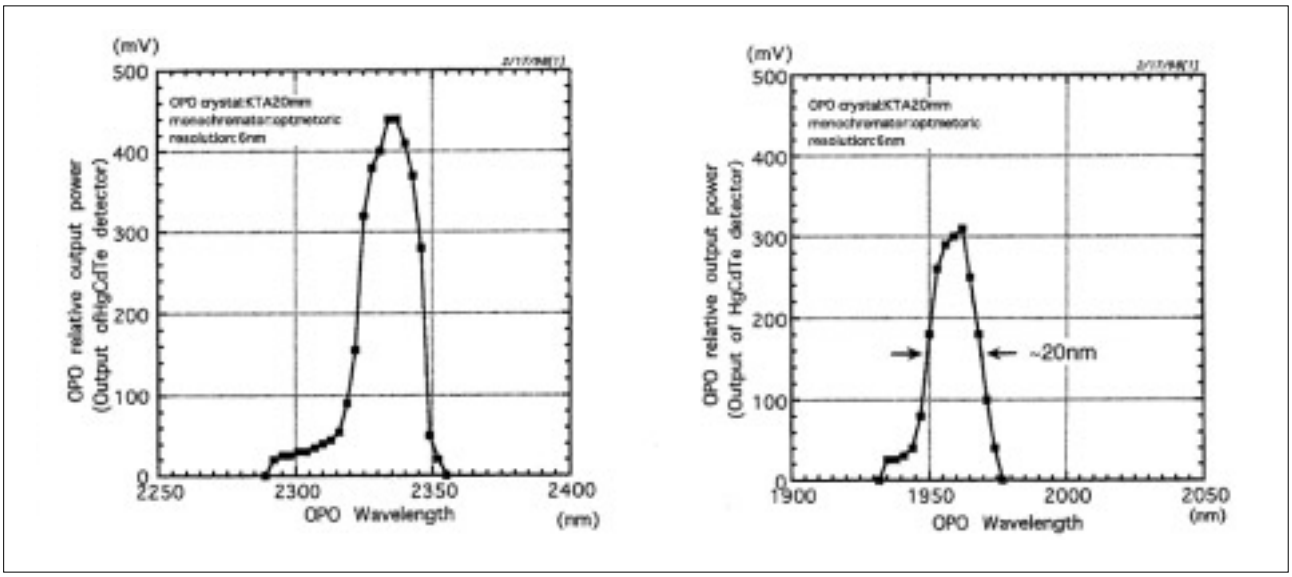
Output Energy in each stage

	Nd:YAG fundamental	*Nd:YAG SHG*	*Nd:YAG 4HG*	*Nd:YAG 5HG*	*OPO 1962n& 2336nm*	*SFM 192nm*
		BBO	*CLBO (8.0mm)*	*CLBO (5.0mm)*	*KTA (20mm)*	*CLBO (3.1mm)*
10Hz	250mJ	90.3mJ	50.2mJ	36mJ	10.8mJ (in:65mJ)	3.8mJ (192nm/5HG=10.5%) (192nm/1ω=1.5%)
100Hz	250mJ	90.3mJ	44.9mJ	19.8mJ	10.4mJ (in:59mJ)	2.1mJ (192nm/5HG=10.7%) (192nm/1ω=0.85%)
Output ratio 100Hz/10Hz		1.0	0.89	0.55	0.96	0.55



参考資料





CLBO/LBO as the final SFM crystal

	193nm SFM	193nm SFM
Crystal	CLBO	LBO
P.M.Type	Type2	Type1
cut Angle	Θ=50 ° ϕ=0 °	Θ=90 ° ϕ=54.8 °
Length(mm)	3.1	5.0
deff(pm/V)	0.93	0.49
Spectral Band width （nm*cm） for OPO	0.172 （0.57nm, L=3mm）	0.205 （0.41nm, L=5mm）
Temperature Band width (℃*cm)	7.1 (23.8℃, L=3mm)	5.3 (10.6℃, L=5mm)

参考資料

Conclusion

1.By using CLBO as the final mixing crystal we experimented 192nm /193nm generations.

- by mixing 2É m OPO output and Nd:YAG 5th harmonic
  3.8mJ at 10Hz
  2.1mJ at 100Hz
- The spectral narrowing of the OPO output and the suppressing of thermal dephasing in the 5HG are important to improve the total conversion efficiency.

2.The efficiency comparison between CLBO and LBO in the final mixing stage was experimented.

- CLBO generated larger output than LBO at both 10Hz and 100Hz repetitions.