

TI-203

Development of the Infrared Ionizing Laser for the Production of Thallium-203 Atoms and System Characteristics

150

102

(thallium) - 203

- 201

SPECT(Single Photon Emission Computed Tomography)

- 201

가 가

TI - 203

- 203

UV

가

- 203

4

, 4

Abstract

TI-201, cyclotron produced from TI-203 stable isotope, is used in myocardial perfusion imaging for the diagnosis and localization of myocardial infarction in SPECT(Single Photon Emission Computed Tomography). As demand for TI-201 increases, demand for more efficient TI-203 stable isotope production technologies increases as well. In the optical pumping method for producing TI-203, an infrared laser is used for the excitation of thallium atoms by highly excited an UV pulsed laser. In this report, we developed laser amplifier system in the ionization stage. The single stage amplifier characteristics including its thermal effects and multi-pass amplification were investigated to develop high power IR laser system used for the production of TI-203 stable isotopes.

1.

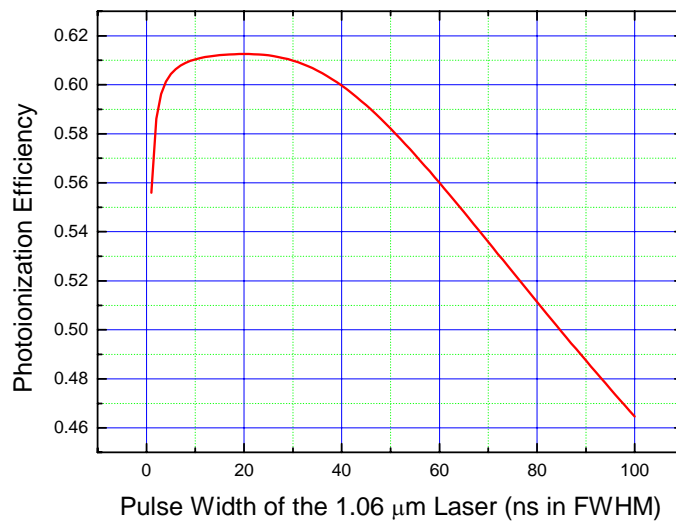
가 98% TI-203 SPECT(Single Photon
Emission Computed Tomography) TI-201 ,
. TI-203 ,
TI-203 .
CW , UV
, (Ionization Limit) ,
TI-203 .
60 ns
가 40 mJ 80% 가 .
kHz , kHz ns
[1 - 3].
60 ns , kHz mJ
, .
MOPA(Master Oscillator Power Amplifier) .
MOPA , .
4 .
가 [4]. ,
, [5 - 10].
Relay Optics
[11 - 15].
, Relay Optics
. DPSSL(Diode Pumped Solid State Laser) ,
가 (10 kW) MOPA

2.

가)

$^2P_{1/2} - ^2S_{1/2}$ $0 - 26479 \text{ cm}^{-1}$
 $^2P_{3/2}$ $(E = 7793 \text{ cm}^{-1})$
 UV $(E = 42011 \text{ cm}^{-1})$
 ns , UV 30 ns ,
 UV 30 ns
 1(b)
 60 ns 90% 가 ,
 가 가
 가 가 가 20 mJ/cm² 50%
 가 , 40 mJ/cm² 80% 가 ,
 60 ns 가 40 mJ/cm² 가
 가 가
 가 1000°C TI 400
 m/s , 1 cm , 가 5 10 cm
 120 250 μs 5 10 kHz
 kHz

6



1.

) 4 pass

1.5

4

2

He - Ne

, Analyzer

(a), (b), (c) (d)

Analyzer

He - Ne

가

8 kW

가 17% 가

[2(b)].

“Relay Optics Scheme”

“Stimulated

Raman Scattering”

가

가

Relay Optics

- Faraday Rotator -

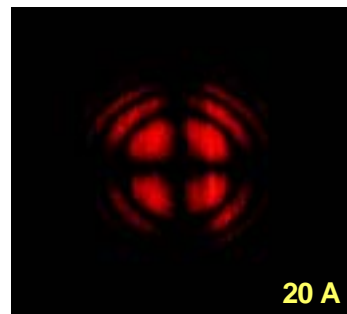
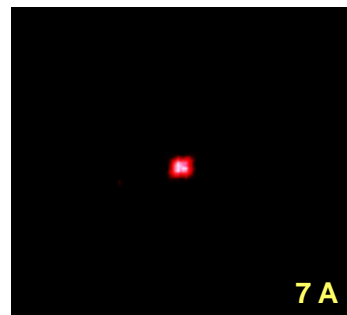
(l₁)

(l₂)

(1)

$$l_1 = f_1 \tag{1}$$

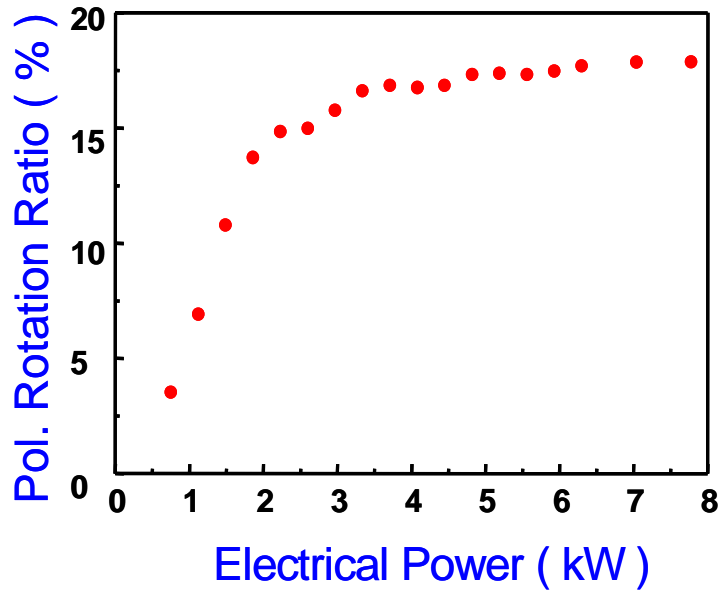
$$l_2 = f_1 - \frac{l_{Nd:YAG}}{2n_{Nd:YAG}} - \frac{l_{TGG}}{2n_{TGG}}$$



2(a) He - Ne

가

Analyzer



2(b)

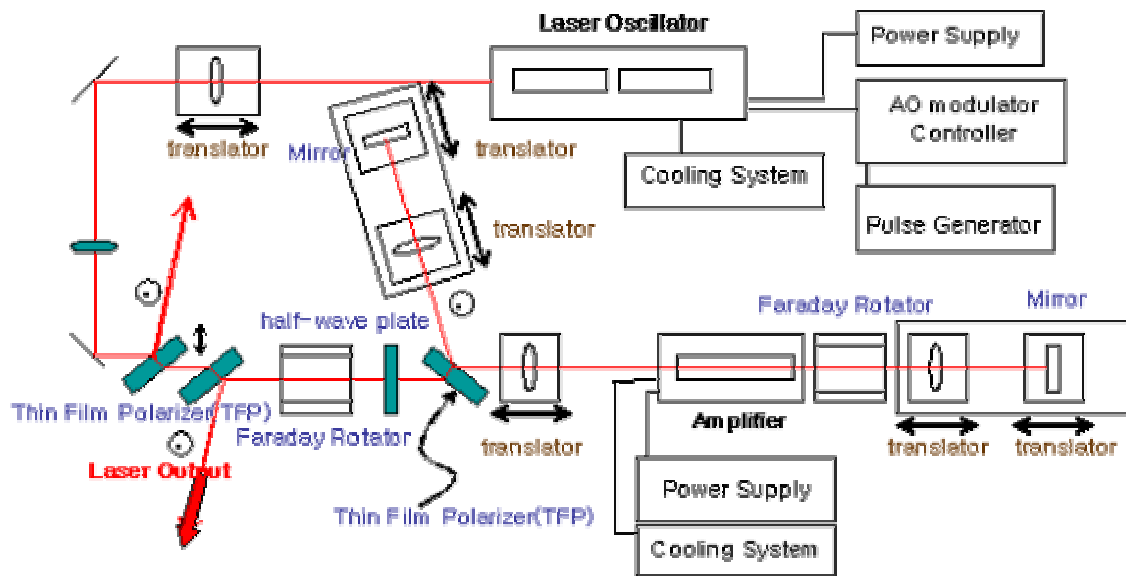
He - Ne

가

가

DPSSL(Diode Pumped Solid State Laser) (IMC
 80 W AO(Acousto - Optic) modulator(Gooch - Housego
 Company, 100 W) 10 kHz 80 W, 40 ns
 , 6 kHz 60 W 40 ns
 TFP(Thin Film Polarizer) 가
 Faraday Rotator Half - wave plate Optical Isolator
 Optical Isolator
 , 4
 Faraday Rotator
 TFP , 가
 Isolator
 Optical Isolator TFP
 Nd:YAG 162 mm, 7 mm
 0.6 w.t% 5 kW 2
 2 24 ,
 6.8 mm aperture 가
 2 ,
 17% 2

5%



3.

3.

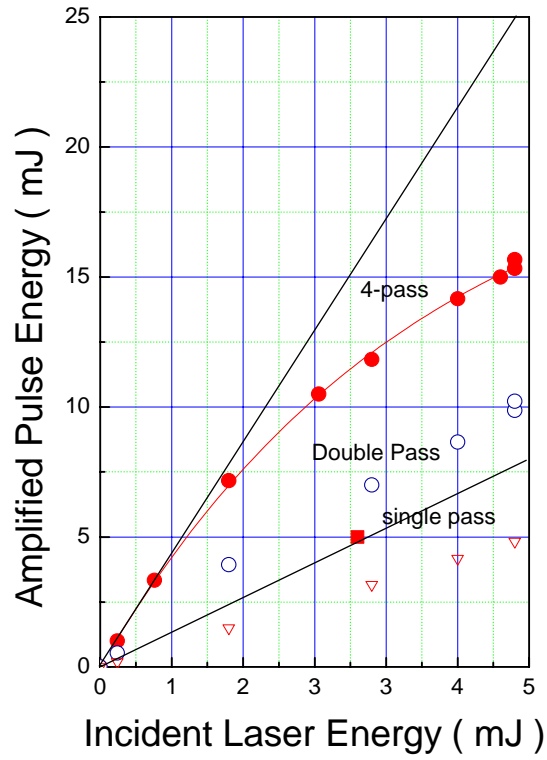
a)

6 kHz , 4 , 4 .
 6 kHz 5 mJ 가 ,
 40 ns 가 , 7.5 kW , 1.5 가
 2.2 , 4 , 가
 5 mJ 16 mJ 3.2 가
 가 가 8.5 kW 18.5
 mJ

b)

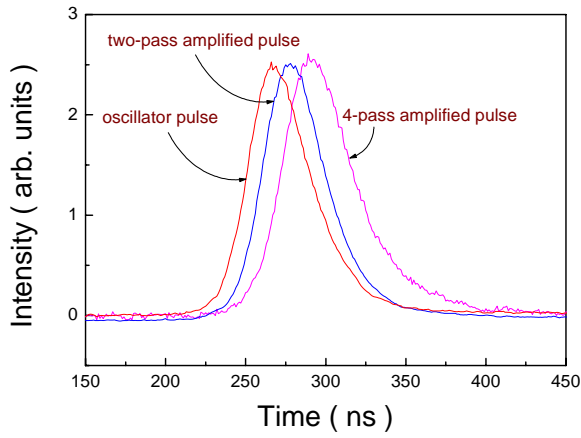
5(a)

6 kHz 40 ns , 4
 48 ns가 20% 가 가
 가

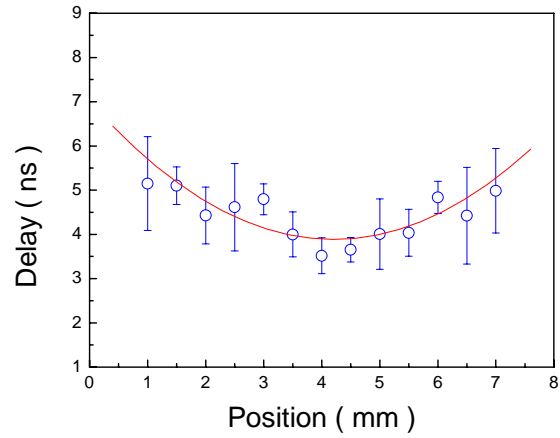


4.

7,5 kW



(a)



(b)

5.

(a).

(b).

가

(1 mm)

(translator)

5(b)

가 mm 가
 가 2 ns 가
 가 8 ns
 가 5%
 가

3.

TI - 203 TI
 MOPA MOPA TI 50% 20 mJ
 , 4 , 4 5% 가
 5 mJ 50% MOPA 6 kHz
 ns 가 40 ns 가 48
 2 ns 가 4
 8 ns 가 , 가
 가 , 가
 , 10 kHz 40 mJ 가
 가

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