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WO 2001/23922  
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- 1 -

가  
1530nm 1625nm  
가  
250nm 1350nm  
가  
가

1

, , , , .

1999 9 29  
60/199,938

60/156,768 2000 4 27

,

가 . 가  
nm 1625nm 가 . 가  
1530nm 1570nm  
1570nm 1700nm L ,  
1250nm 1570  
1350nm  
가 가

. WDM (WDM) 4  
가 , 가  
가

, 가 가  
가

가

,

가 08/559,954 .

08/559,954 ,  
가 , 2.0 ps/nm - km 가 4 .

1530nm 1570nm , 1250nm  
;

1530nm 1570nm 가 ;

1530nm 1625nm 2.0 ps/nm - km ,

1570nm 1625nm 0.25 dB/km 가 ,

가 가 가 .

가 가 4,715,679 .

( r)%

$$A_{\text{eff}} = 2 \int_0^E E^2 r dr / \int_0^E E^4 r dr , \quad 0 , E$$

$$(D_{\text{eff}}) \quad A_{\text{eff}} = (D_{\text{eff}}/2)^2 .$$

WDM

SPM , 가 가  
. SPM 가

FWM 4 , 2 가 가

$$\%_i , \% = 100 \times (n_i^2 - n_c^2) / 2n_i^2 , n_i$$

$$, n_c .$$

$$1 - [ |b - b_0| / (b_1 - b_0) ] (b)\% , b_0$$

$$, b , b_i , b , b_f , \% , b_i , b_1 (b)\% , (b)\% = (b_o) ($$

$$, b_f$$

$$\% = \frac{(b_a) + [(b_0) - (b_a)] \{1 - [ |b - b_0| / (b_1 - b_0) ] \}}{1} \quad (b)$$

가 , 가 2가 10 5mm 0.67mm .

0 가 30N 가 0.185mm 가 70N 가 0.178mm 가 2 #7 가 (dB/m) .

1530nm 1625nm 가 1310 1km .

1 가 (r)%  $r_0$  (r<sub>0</sub>) 5.8μm 18μm (r)% 80μm<sup>2</sup> , 0.20dB/km 1550nm .

1 3 AB CD 2 4 EF GH 1 2 .

2	(r)%	1 +/- 0.2μm	=1	(r)%	0.8%	0.9%	0.35%	0.4
1%	(r <sub>0</sub> )	10μm	1550nm	100μm <sup>2</sup>	105μm <sup>2</sup>	1550nm	0.065 ps/nm <sup>2</sup> - km	0.067 ps/nm <sup>2</sup> - km
							0.182dB/km	0.186dB/km
3	0.6%	0.7%	11.5μm	12.5μm	(r)	(r)%		
	(r)%	0.35%	0.37%	r=1 +/- 0.1μm	(r)%	0.48%	0.5%	r=2 +/- 0.1μm
	(r)%	0.14%	0.16%	r=3 +/- 0.1μm	(r)%	0.24%	0.26%	r=4 +/- 0.1μm
				r=5 +/- 0.1μm	(r)%	0.05%	0.08%	
				r=5 +/- 0.1μm	(r)%	0.05%	0.08%	
				r <sub>0</sub>				
5μm <sup>2</sup>	1550nm	0.066 ps/nm <sup>2</sup> - km	0.068 ps/nm <sup>2</sup> - km	1550nm	0.186dB/km	0.190dB/km	80μm <sup>2</sup>	8
4	0.40%	1.05%	5.3μm	7μm				
r <sub>0</sub>	(r)%	5	JK	LM				
	1310nm	80μm <sup>2</sup>	1550nm	0.335dB/km	0.22dB/km	1550nm	0.25dB/km	0.20dB/km
	(r)	(r)%	0 r	6 +/- 0.2μm	r=1 +/- 0.2μm	(r)		
%	0.30%	0.40%	0	1 +/- 0.2μm	0.8	1.2	가	
		4 +/- 0.2μm	(r)%	0.23%	0.33%	4 +/- 0.2μm	r	5 +/- 0.2μm
(r)%		5 +/- 0.2μm	(r)%	0.05%	0.15%	5 +/- 0.2μm	r	6 +/- 0.2μm
0.2μm	(r)%	6 +/- 0.2μm	(r)%					
5	가	가	가	1	23			
1								
2								

3 , ,

4 , ,

5 , ,

6 5 2 , .

3, 4 5 . , 3 (10)(12) , 가  
 (AB)(CD) . (10) 가 (12)

3 (10)(12) . , 1 가

4 2 가 (14)

5 ( (J) (K) 가 18)( (L) (M) 가 22) 3  
 가 ( (N) (P) 가 20)

[ 1 ]

	D1550ps/nm - km	1550nmps/nm <sup>2</sup> - km	MFD $\mu$ m	A <sub>eff</sub> $\mu$ m <sup>2</sup>	nm	dB	1550 dB/km	dB/m
	19.2	0.068	11.934	109	1755	12.6	0.186	0.97
	16.8	0.061	10.677	85	1340	1.0	0.184	0.62

1550nm , C 1530nm  
 1570nm L 16  
 25nm , ,

2 ps/nm - km , 0.08 ps/nm<sup>2</sup> - km ,

가 ,

1625nm 25 ps/nm - km . 1625

nm 16 ps/nm - km .

FWM , SPM .

2 2 . 1 2

[ 2 ]

	D1550ps/nm - km	1550nmps/nm <sup>2</sup> - km	MFD $\mu$ m	A <sub>eff</sub> $\mu$ m <sup>2</sup>	nm	dB	1550 dB/km	dB/m
	13.0	0.070	10.99	89	1599	20	0.189	0.82
	10.9	0.065	10.44	80	1187	5	0.187	0.63

3 , 1310nm  
 . - OH 가 , 1310nm 1250nm 1  
 350nm .

[ 3 ]

	(nm)	(ps/nm <sup>2</sup> - km)	MFD( $\mu$ m)	(nm)	1310nm (dB/km)
	1322	0.0924	9.8	1330	0.334
	1301	0.088	8.8	1180	0.332

3 80 $\mu$ m<sup>2</sup> . 3 SMF - 28  
 , 1310nm 가  
 . 3 1550nm 0.188dB/km

3 가 6 (24)(26) . (24)(26)  
 0.8 1.3 가 (A)(A'), (B)(B'),  
 (C)(C'), (D)(D') .

1

1 가 . 1 3  
 . 1 가  
 2 . 0.86% , 1 $\mu$ m  
 1 0.38% (r)% . 4 , 9.5  
 $\mu$ m r<sub>0</sub> . 1 ,

1550nm 17.9 ps/nm - km ;

1550nm 0.066 ps/nm<sup>2</sup> - km ;

1589 ( c );

1550nm 11.7 $\mu$ m ;

1550nm 103 $\mu$ m<sup>2</sup> (A<sub>eff</sub> );

1550nm 0.84dB/km ; .

1 1550nm 0.187dB/km , 13.3 $\mu$ m .

2

2 가 . 2 4  
 [0.45%, 1 $\mu$ m], [0.33%, 2 $\mu$ m], [0.24%, 3 $\mu$ m], [0.15%, 4 $\mu$ m] [0.06%, 5.6 $\mu$ m] [0.64%, 0],  
 [ (r)%, r]

8 5.6 $\mu$ m , 11.8 $\mu$ m r<sub>0</sub> . 1

1550nm 11.4 ps/nm - km ;

1550nm 0.067 ps/nm<sup>2</sup> - km ;

1515 ( c);

1550nm 10.6 $\mu$ m ;

1550nm 82 $\mu$ m<sup>2</sup> (A<sub>eff</sub>);

1550nm 0.188dB/km ; .

, 1530nm 1565nm, 1565nm 1625nm C L

2가

(57)

1.

가 ;

; ,

(n<sub>c</sub>) 가 ,

( (r)%) , r=

0 (r)%= 0%

(r)%=0 r=r<sub>0</sub>

,

0.25% 0 1.0% , 5.8 $\mu$ m r<sub>0</sub> 18 $\mu$ m , 0 r r<sub>0</sub> ( (r)%)

,

1550nm 80 $\mu$ m<sup>2</sup> , 0.20dB/km

.

2.

1 , 3 AB , 3 DC



3.

2 , 1340nm 1755nm  
가 .

4.

2 , 1550nm , 10 $\mu$ m 12 $\mu$ m ,  
13dB .

5.

4 , 1550nm 1 dB/m .

6.

2 , 1520nm 1625nm 0.06 ps/nm<sup>2</sup> - km 0.07 ps/nm<sup>2</sup> -  
km , 1550nm 16 ps/nm - km 20 ps/nm - km .

7.

1 , 1550nm 85 $\mu$ m<sup>2</sup> .

8.

1 , 1550nm 95 $\mu$ m<sup>2</sup> .

9.

2 , 1550nm 85 $\mu$ m<sup>2</sup> 109 $\mu$ m<sup>2</sup> .

10.

1 , 4 EF , 4 GH .

11.

10 , 1180nm 1600nm  
가 .

12.

10 , 1550nm , 10.5 $\mu$ m 11 $\mu$ m ,  
20dB .

13.

12 , 1550nm 0.9 dB/m .

14.

10 , 1550nm 1520nm 1625nm 0.06 ps/nm<sup>2</sup> - km 0.07 ps/nm<sup>2</sup> - km  
km , 1550nm 10.9 ps/nm - km 13 ps/nm - km .

15.

10 , 1550nm 85μm<sup>2</sup> .

16.

10 , 1550nm 80μm<sup>2</sup> 89μm<sup>2</sup> .

17.

가 ;

; ,

(n<sub>c</sub>) 가 ,

0 (r)% = 0% (r)% = 0 r = r<sub>0</sub> , r =

0.8% 0 0.9% , 9μm r<sub>0</sub> 10μm ,

(r)% 0 r 1+/- 0.2μm 1 가 ,

r = 1+/- 0.2μm (r)% 0.35% 0.41% ,

(r)% 1+/- 0.2μm r r<sub>0</sub> .

18.

17 , 1550nm 1520nm 1625nm 0.065 ps/nm<sup>2</sup> - km 0.067 ps/nm<sup>2</sup> - km  
2 - km , 1550nm 100μm<sup>2</sup> 105μm<sup>2</sup> , 1550nm 0.182 dB/km 0.  
186 dB/km .

19.

가 ;

; ,

(n<sub>c</sub>) 가 ,

0 (r)% = 0% (r)% = 0 r = r<sub>0</sub> , r =

0.6% 0 0.7% , 11.5μm r<sub>0</sub> 12.5μm ,

(r)% 0 r 5+/- 0.2 $\mu$ m ,

r=1+/- 0.1 $\mu$ m (r)% 0.48% 0.5% ,

r=2+/- 0.1 $\mu$ m (r)% 0.35% 0.37% ,

r=3+/- 0.1 $\mu$ m (r)% 0.24% 0.26% ,

r=4+/- 0.1 $\mu$ m (r)% 0.14% 0.16% ,

r=5+/- 0.1 $\mu$ m (r)% 0.05% 0.08% ,

(r)% 5+/- 0.1 $\mu$ m r r<sub>0</sub> .

20.

19 , 1520nm 1625nm 0.066 ps/nm<sup>2</sup> - km 0.068 ps/nm<sup>2</sup> - km  
<sup>2</sup> - km , 1550nm 80 $\mu$ m<sup>2</sup> 85 $\mu$ m<sup>2</sup> , 1550nm 0.186 dB/km 0.1  
 90 dB/km .

21.

가 ;

;

(n<sub>c</sub>) 가 ,

0 (r)%= 0% ( (r)%) , r=  
 (r)%=0 r=r<sub>0</sub> ,

0.40% 0 1.05% , 5.3 $\mu$ m r<sub>0</sub> 7 $\mu$ m , 0 r r<sub>0</sub> ( (r)%)

,

1310nm 80 $\mu$ m<sup>2</sup> 0.335dB/km , 1550nm 0.25dB/km

.

22.

21 , 5 JK , 5 LM

.

23.

21 , 0.40% 0 0.75% , 4.8 $\mu$ m r<sub>0</sub> 6.8 $\mu$ m ,

(r)% 0 r 1+/- 0.2 $\mu$ m 1 가 ,

r=1+/- 0.2 $\mu$ m (r)% 0.30% 0.40% ,

(r)% 1+/- 0.2 $\mu$ m r 4+/- 0.2 ,  
 r=4+/- 0.2 $\mu$ m (r)% 0.23% 0.33% ,  
 (r)% 4+/- 0.2 $\mu$ m r 5+/- 0.2 ,  
 r=5+/- 0.2 $\mu$ m (r)% 0.05% 0.15% ,  
 (r)% 5+/- 0.2 $\mu$ m r 6+/- 0.2 ,  
 6+/- 0.2 $\mu$ m (r)% .

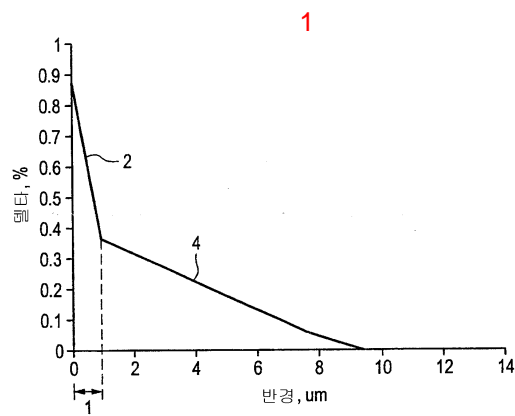
24.

가 ;

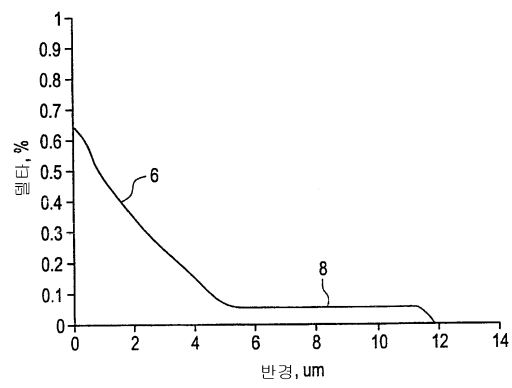
, 가 ; ,

가 1 23

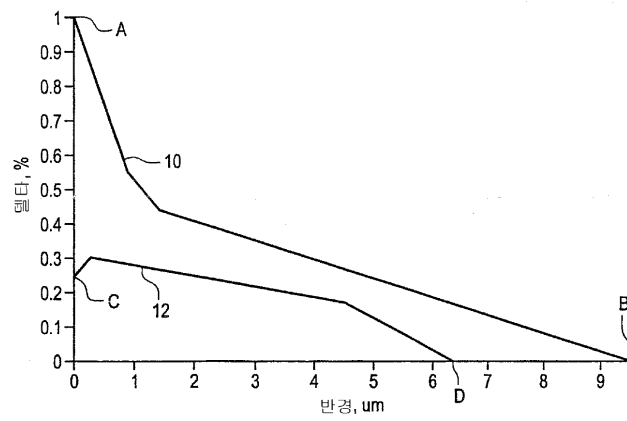
가



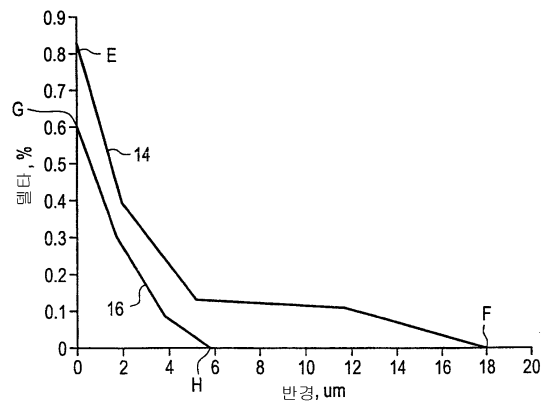
2



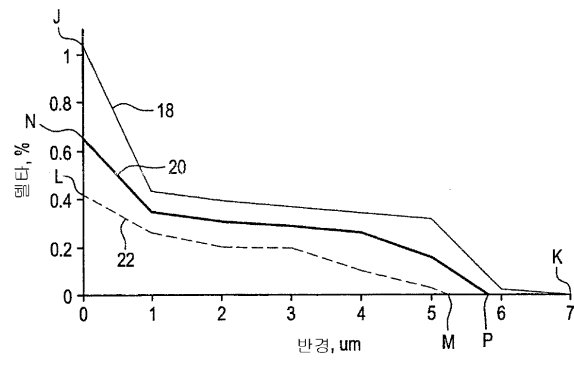
3



4



5



6

