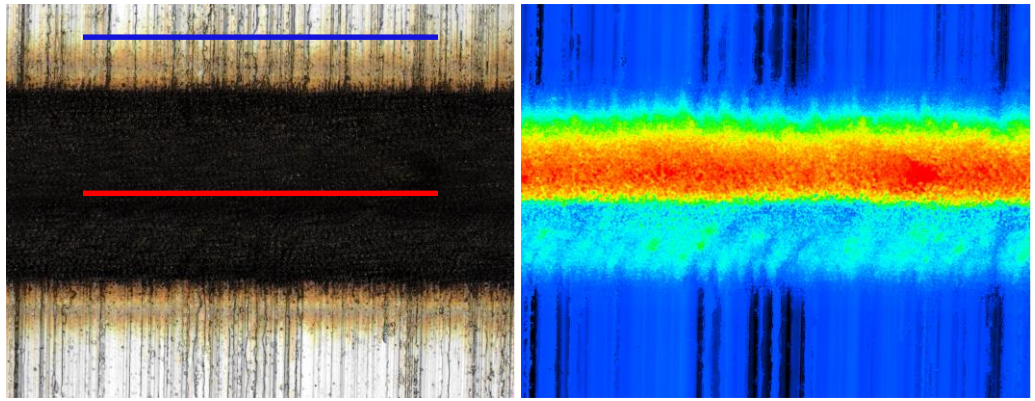
20200514_연구회

신영관

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
190 fs	200 kHz	20x	x	3000 mW

Attenuation : 100%, 1mm/s



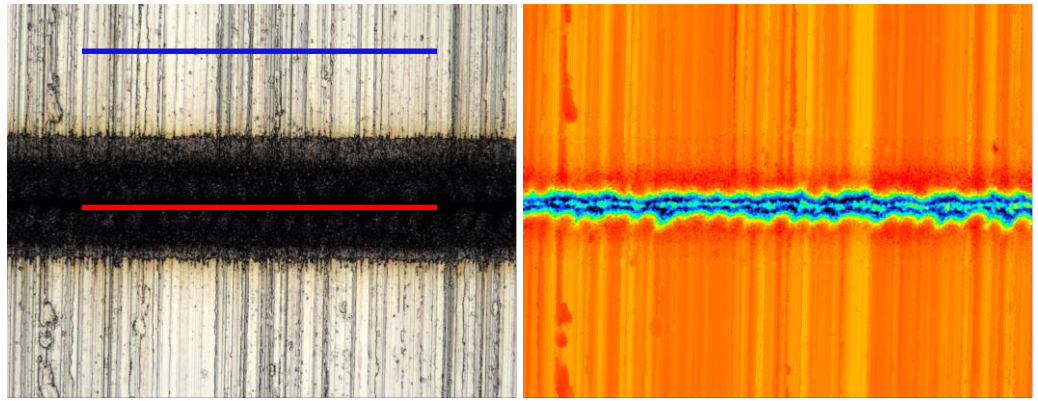
Red

Ra[㎛]	Rz[㎛]
0.625	4.354

Blue

Ra[㎛]	Rz[㎛]
0.160	1.056

Attenuation : 20%, 1mm/s



Red

Ra[㎛]	Rz[㎛]
0.659	3.371

Blue

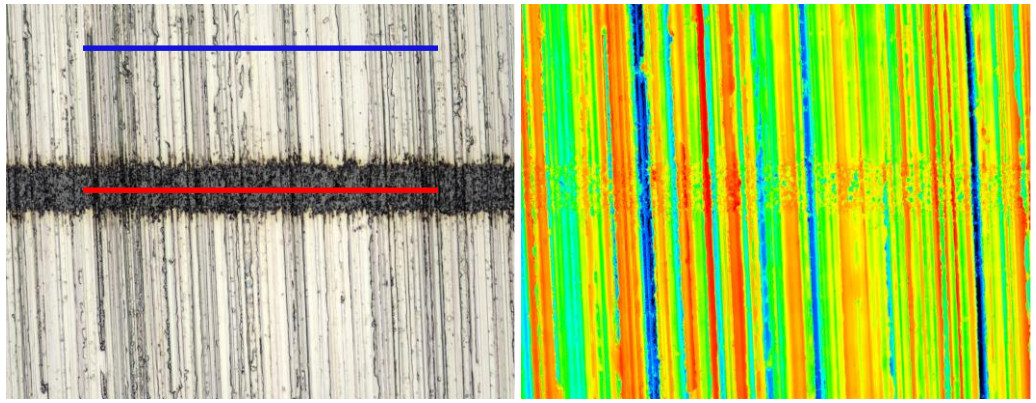
Ra[㎛]	Rz[㎛]
0.167	1.192

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
190 fs	200 kHz	20x	2.0	3000 mW

ND 필터 사용하여
파워 낮추기

Attenuation : 100%, 1mm/s



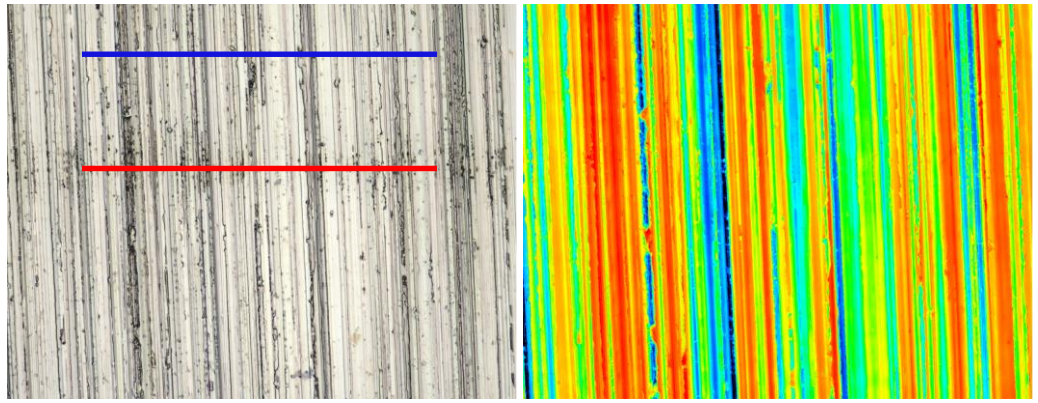
Red

Ra[㎛]	Rz[㎛]
0.191	1.167

Blue

Ra[㎛]	Rz[㎛]
0.173	0.961

Attenuation : 60%, 1mm/s



Red

Ra[㎛]	Rz[㎛]
0.153	0.920

Blue

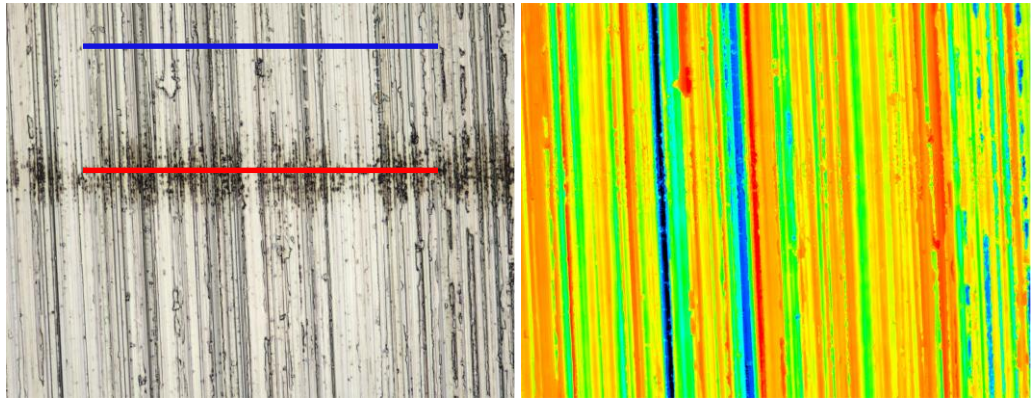
Ra[㎛]	Rz[㎛]
0.158	0.879

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
190 fs	100 kHz	20x	2.0	3000 mW

반복률 낮춰서 중첩 낮추기

Attenuation : 100%, 1mm/s



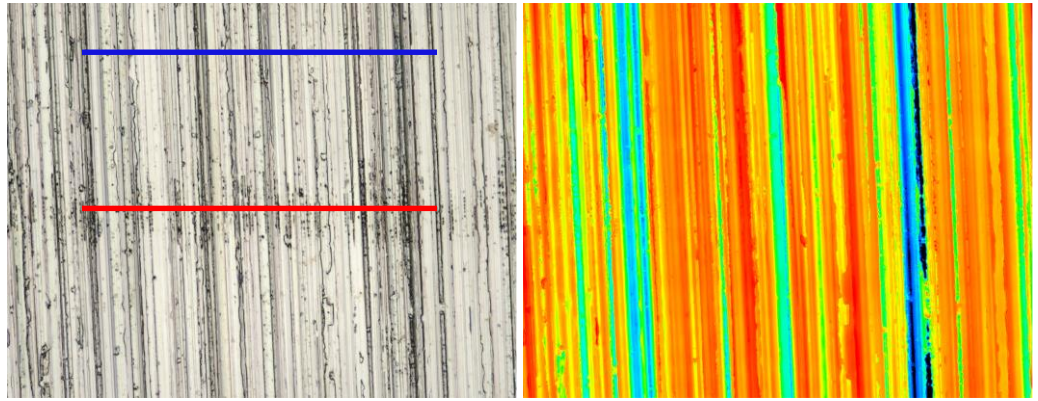
Red

Ra[㎛]	Rz[㎛]
0.174	1.120

Blue

Ra[㎛]	Rz[㎛]
0.173	1.018

Attenuation : 80%, 1mm/s, overlap 3번



Red

Ra[㎛]	Rz[㎛]
0.174	1.120

Blue

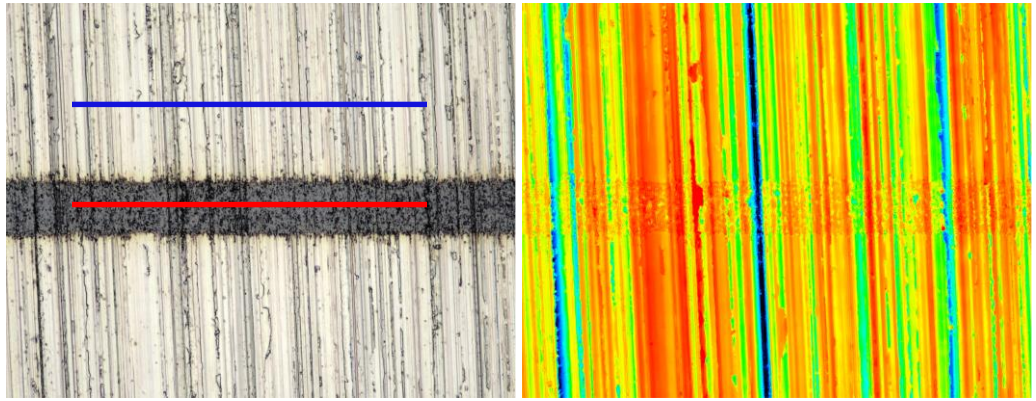
Ra[㎛]	Rz[㎛]
0.174	1.018

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
190 fs	200 kHz	20x	2.0	3000 mW

파워 낮추고, 속도 낮추어, 저 파워로 중첩 더하기

Attenuation : 100%, 0.5mm/s



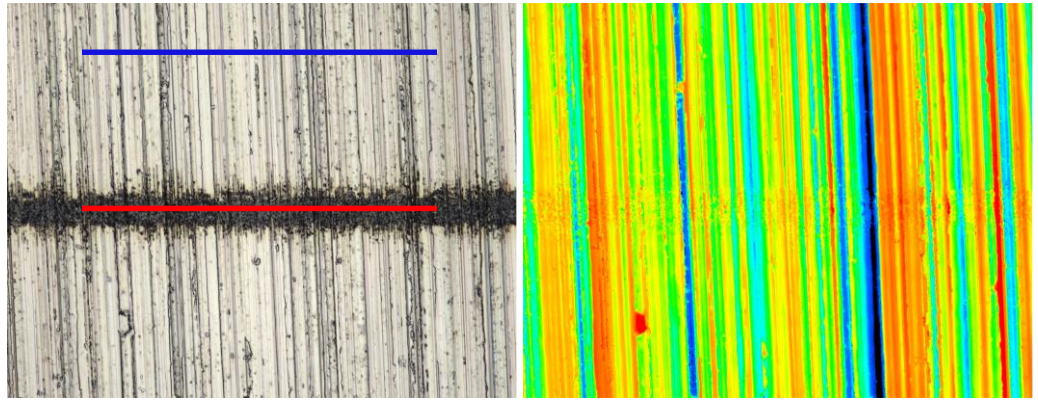
Red

Ra[㎛]	Rz[㎛]
0.139	0.865

Blue

Ra[㎛]	Rz[㎛]
0.135	0.809

Attenuation : 80%, 0.5mm/s



Red

Ra[㎛]	Rz[㎛]
0.169	1.129

Blue

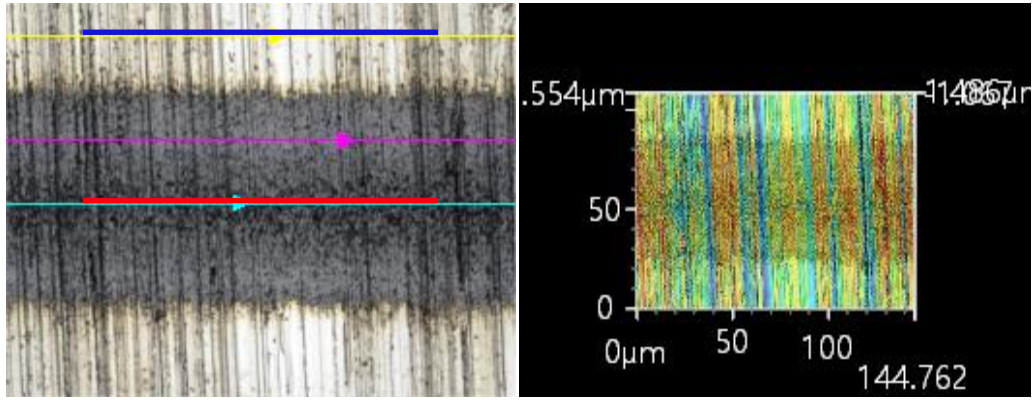
Ra[㎛]	Rz[㎛]
0.154	0.908

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
190 fs	200 kHz	10x	2.0	3000 mW

대물렌즈 바꿔서 인텐시티 낮추기

Attenuation : 60%, 0.5mm/s



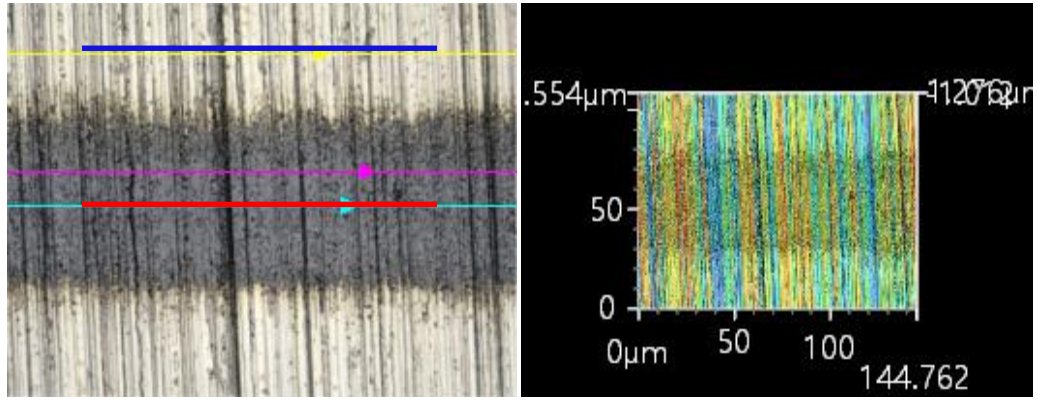
Red

Ra[µm]	Rz[µm]	RSm[µm]
0.151	0.911	6.191

Blue

Ra[µm]	Rz[µm]	RSm[µm]
0.134	0.747	5.749

Attenuation : 40%, 0.5mm/s



Red

Ra[µm]	Rz[µm]	RSm[µm]
0.157	0.875	6.767

Blue

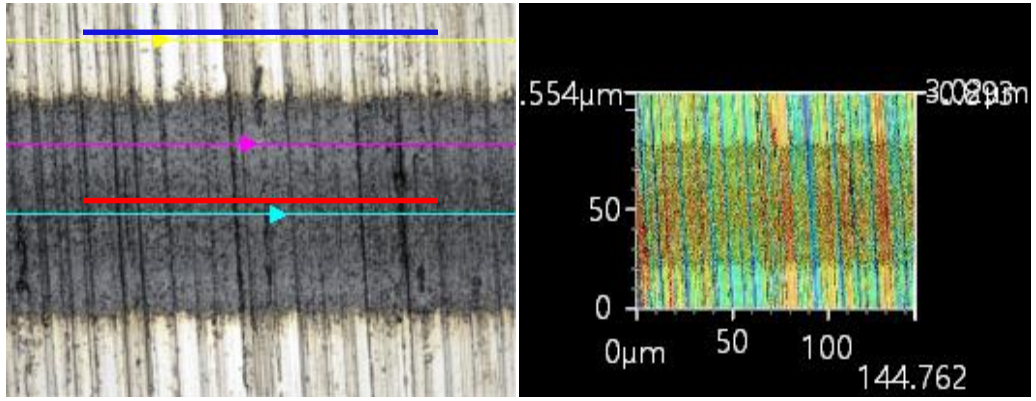
Ra[µm]	Rz[µm]	RSm[µm]
0.150	0.899	7.596

1. Laser polishing test

Pulse width	Repetition rate	Objective lens	ND filter	Program power
1ps	200 kHz	10x	2.0	3000 mW

펄스 폭 변환

Attenuation : 60%, 0.5mm/s



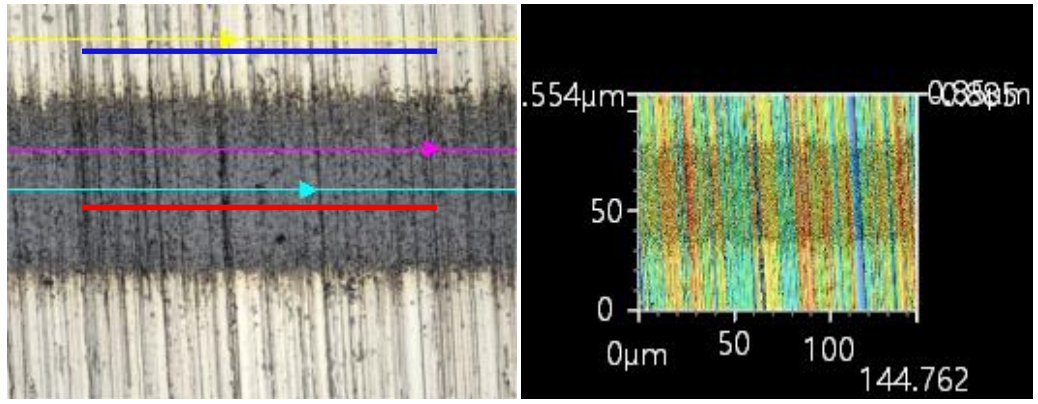
Red

Ra[㎛]	Rz[㎛]	RSm[㎛]
0.128	0.757	5.397

Blue

Ra[㎛]	Rz[㎛]	RSm[㎛]
0.123	0.774	5.177

Attenuation : 40%, 0.5mm/s



Red

Ra[㎛]	Rz[㎛]	RSm[㎛]
0.132	0.847	7.667

Blue

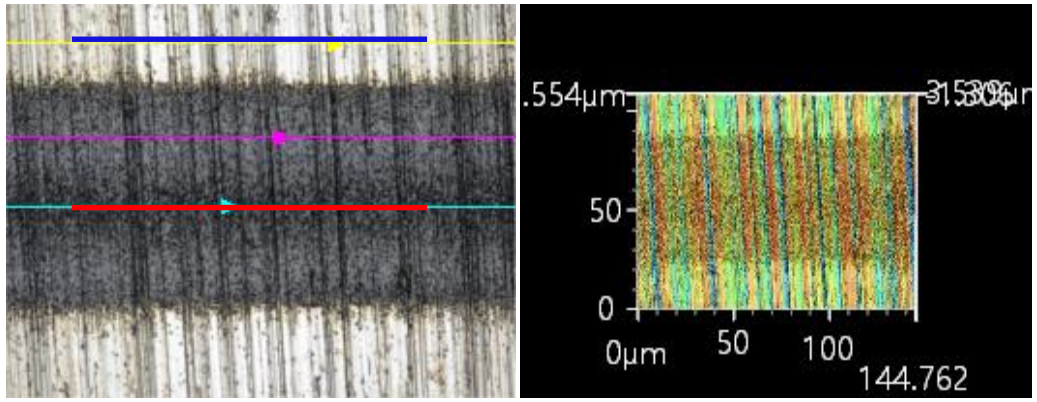
Ra[㎛]	Rz[㎛]	RSm[㎛]
0.130	0.865	5.419

1. Laser polishing test

펄스 폭 변환

Pulse width	Repetition rate	Objective lens	ND filter	Program power
10 ps	200 kHz	10x	2.0	3000 mW

Attenuation : 60%, 0.5mm/s



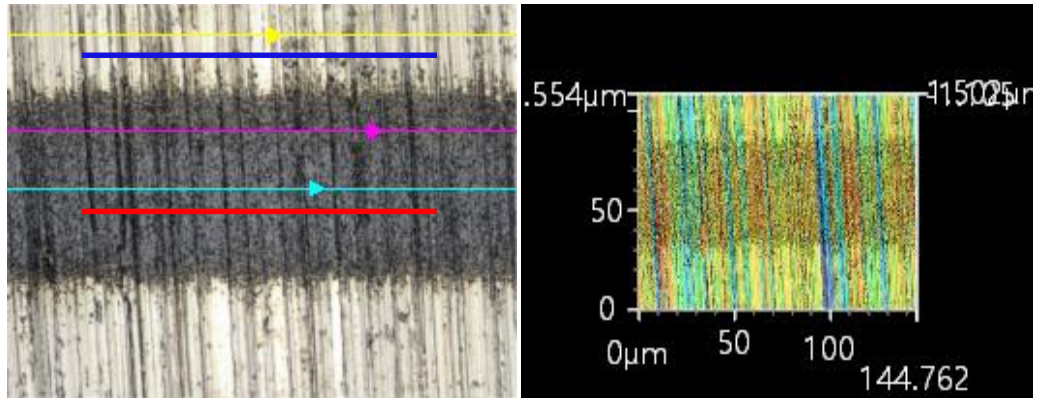
Red

Ra[µm]	Rz[µm]	RSm[µm]
0.213	1.273	5.269

Blue

Ra[µm]	Rz[µm]	RSm[µm]
0.124	0.700	

Attenuation : 40%, 0.5mm/s



Red

Ra[µm]	Rz[µm]	RSm[µm]
0.163	1.032	4.715

Blue

Ra[µm]	Rz[µm]	RSm[µm]
0.147	0.976	5.100

1. Laser polishing test

현재 샘플 및 시스템에서 폴리싱 효과를 기대할 수 없음

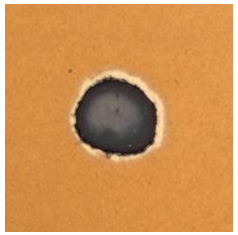
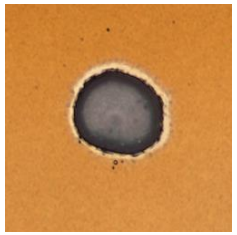
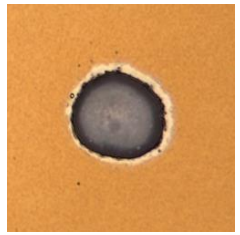
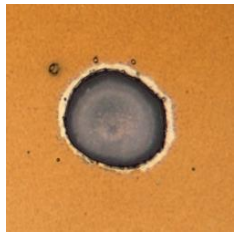
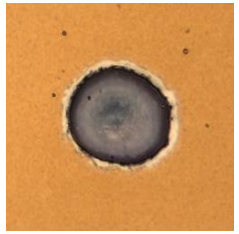
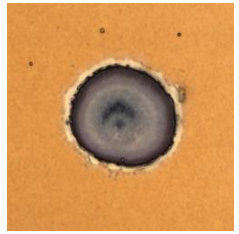
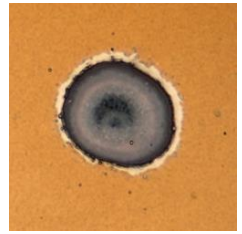
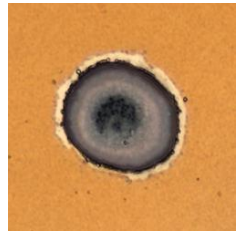
레이저 폴리싱 향후 계획

- 사각빔으로 폴리싱
- 좀 더 거친면 상태에서 폴리싱

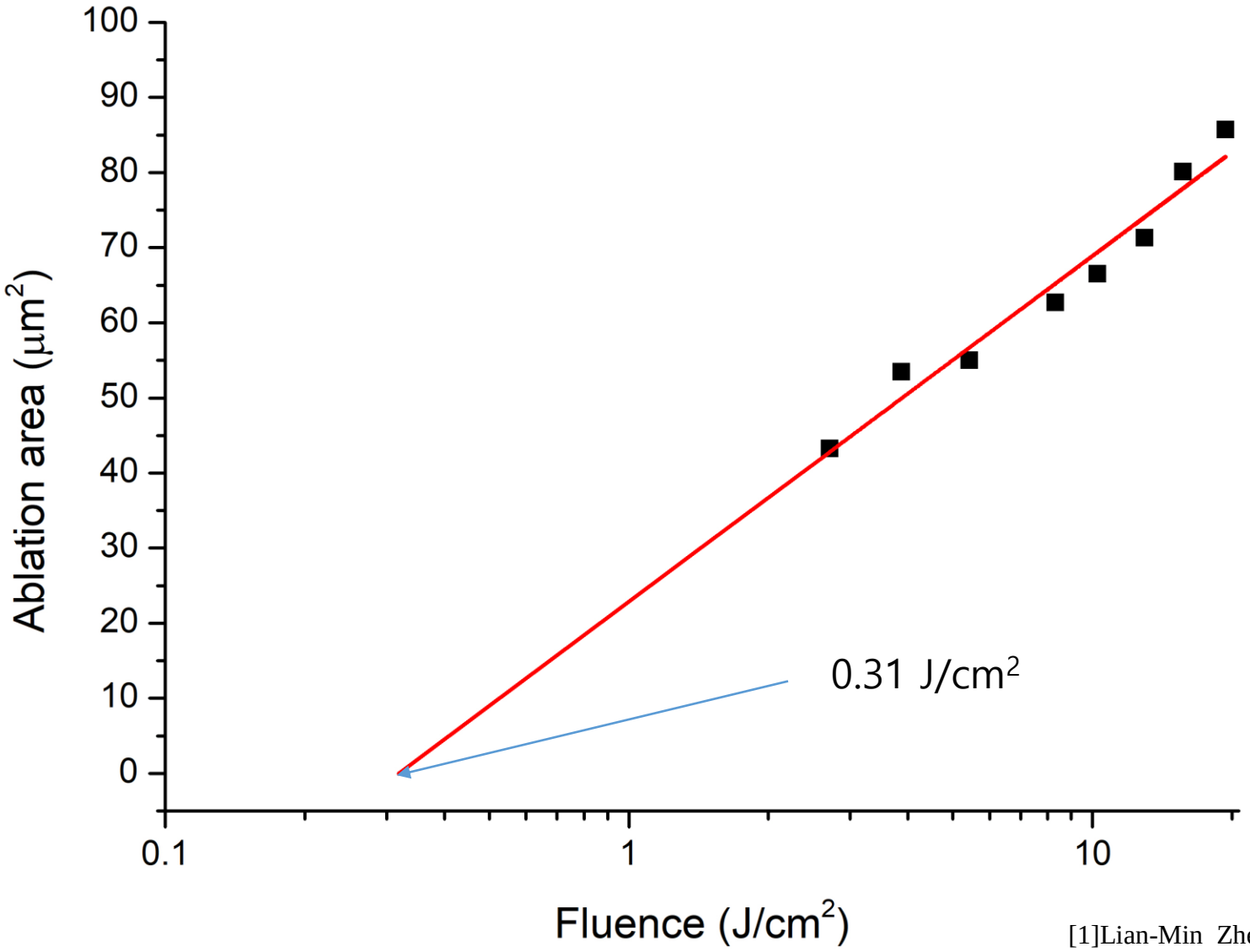
2. BDS 기초 실험(Cu)

Pulse width	Repetition rate	Objective lens	ND filter
190 fs	100 kHz	50x	x

순서	펄스에너지[uJ]
1	1.4
2	2
3	2.8
4	4.3
5	5.3
6	6.7
7	8.1
8	10

1	2	3	4
			
1	6	7	8
			

2. BDS 기초 실험(Cu)



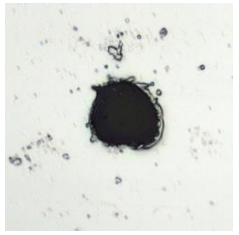
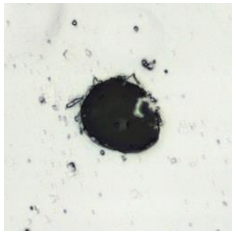
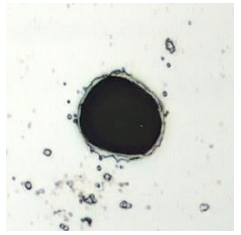
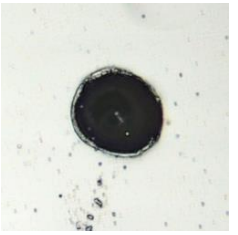
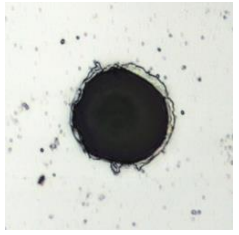
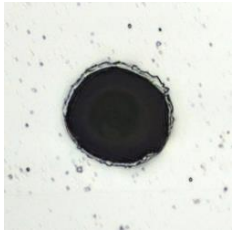
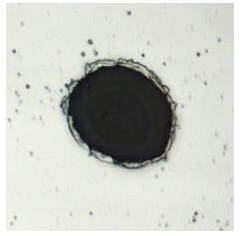
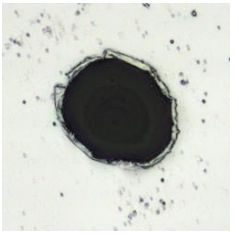
Reference
[1] 0.25 J/cm²

[1]Lian-Min Zheng et al, “Effect of laser pulse heating of copper photocathodes on high-brightness electron beam production at blowout regime”, Chinese physics C

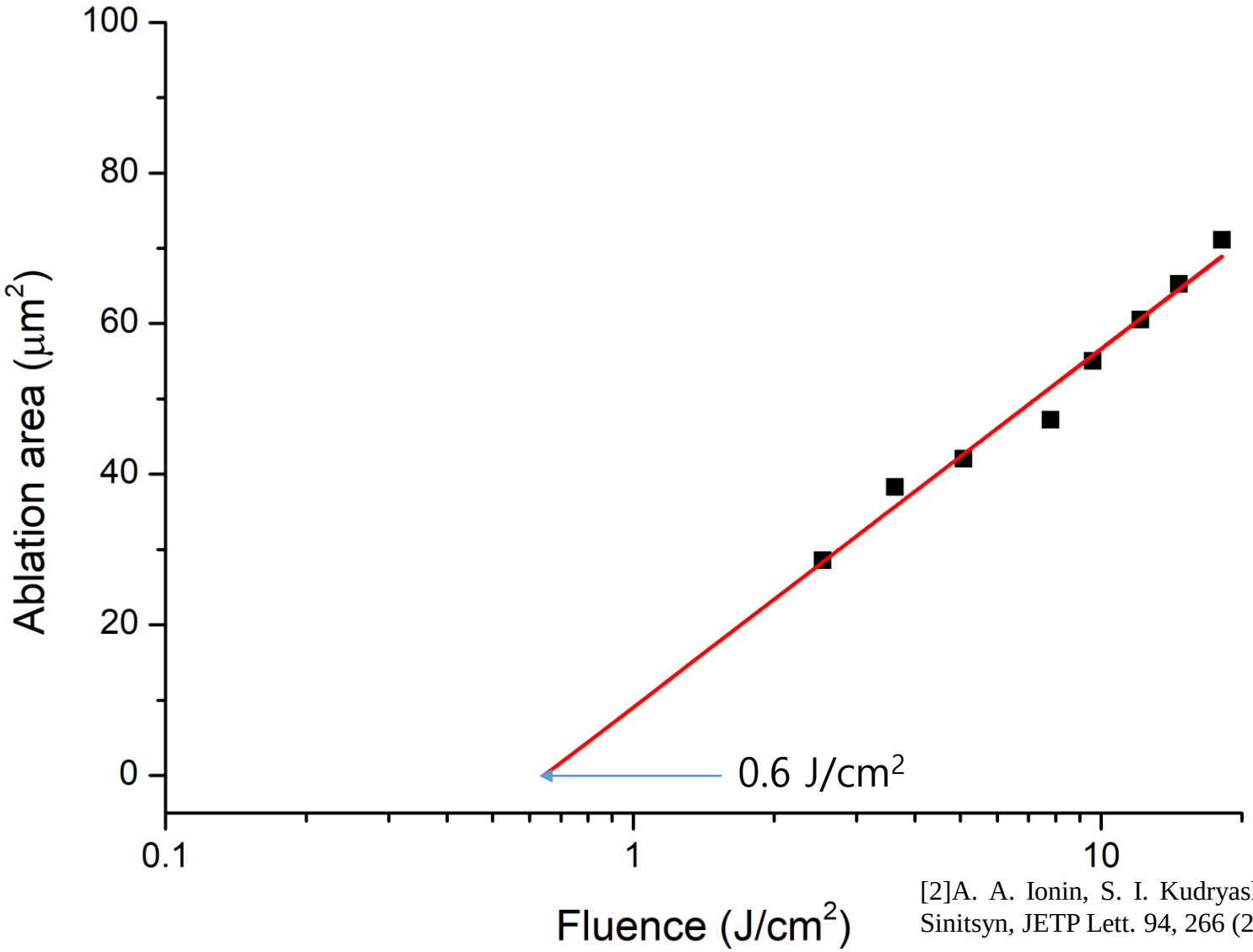
2. BDS 기초 실험(Al)

Pulse width	Repetition rate	Objective lens	ND filter
190 fs	100 kHz	50x	x

순서	펄스에너지[uJ]
1	1.4
2	2
3	2.8
4	4.3
5	5.3
6	6.7
7	8.1
8	10

1	2	3	4
			
1	6	7	8
			

2. BDS 기초 실험(Al)



Reference
[2] 0.5 J/cm²

[2]A. A. Ionin, S. I. Kudryashov, A. E. Ligachev, S. V. Makarov, L. V. Seleznev, and D. V. Sinitsyn, JETP Lett. 94, 266 (2011)

2. BDS 향후 일정

- 현재, 진공펌프 성능에 대하여 의견이 달라, 아인측에서 사용하는 진공 측정 data 요청
- (high pulse energy 사용하기 위해선 10mbar 수준의 진공 필요, 1ps에서는 high energ에서도 82% 효율 보여줌)
- Input 3 W, 100 kHz 일경우, 80% 효율을 보여줌, 그 이후 부터는 급격하게 효율이 떨어짐(62%효율 보여줌)

3. 정밀공학회 논문 리뷰어 답변 제출
4. 광학회 초록 제출