ICVDM Manual

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LDML Lab

ICVDM Setup

0. ccd, linkam, microscope light, 펌프의 기기전원 및 프로그램을 모두 켠다. (기계를 먼저 켜고 , 프로그램을 켜야한다. 아닐시 프로그램 오류)



MFC
 Furnace
 CCD
 Linkam
 Pump

ICVDM Setting Steps



1. Linkam stage 앞 배출구가 막혔는지 확인 후에 고무 호스를 연결한다.



4. Ccd를 활용하여 초점을 맞추어 적당한 위치에 stage를 둔 후 , Tube와 linkam stage 사이에 o-ring을 끼우고 클램프로 단단히 고정시킨다.



2. 적당량의 황가루를 넣은 boat를 Furnace tube의 중심부를 기준으로 우측 16cm 되는 지점에 둔다.



5. MFC에 연결된 밸브와 furnace tube 역시 동일한 방법으로 고정시킨 후에 linkam stage의 뚜껑을 닫는다.



3. 샘플을 Linkam stage에 얹고 커버를 닫는다.



6. 성장을 관찰하려는 위치에 초점을 정확히 맞춘 후에, band pass filter 렌즈를 넣는다. (MoS_2 의 경우 620 nm)

ICVDM Setting Steps



7. MFC기기를 켠다. (그림과 같은 순서로 래 버를 돌리고, ON 버튼을 누를 것.)



플로우 흐를 경우, 래버는 수평방향이며 유량 이 계기판에 표시됨.



8. 기체가 잘 흐르는지 펌프 내 트랩과 책상 기둥에 매달린 트랩을 실험 전 그리고 실험 진행 중 수시로 확인한다.



단, 버블이 나오지 않는 경우 황이 뭉쳐 터질 위험이 있으 9. 디스플레이하고자 하는 프로그램에 따라 스틱 니 실험을 즉시 중단한다. 조작하기

	1	2	3
Nanobase OM	앞	2 or 3	1
PVCam contrast CCD	뒤	2	1
Raman Measurement	뒤	4	2

After Experiments

1. 성장이 완료된 후 Linkam과 Furnace의 승온을 멈추기 위해 각 프로그램을 아래와 같이 조작한다.

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2. Furnace의 온도가 약 700도가 되었을 때, 뚜껑을 열고 나무 조각을 둔 후, 부채질로 속도를 빠르게 낮춘다.



3. 약 300도쯤 되었을 때 Furnace의 뚜껑을 완전 개방하고, ①, ② 순으로 양쪽 클램프를 해제한다..



4. 온도가 내려가며 굳은 황으로 인해 튜브가 깨지지 않도록 Furnace boat를 튜브 끝에 걸치게 살짝 꺼내둔다



Apparatus Maintenance

- Cover glass 교체

(황이 터진 이후 혹은 gas flow가 잘되지 않을 때, 특히 유의하여 살펴볼 것) Cover glass : 22 × 22mm

1) Linkam의 cover부분을 해체하여 교체가 필요한 기존 cover glass를 제거 한 후, 창 주위로 주변 부에 vacuum glass를 얇게 도포한다. 2) 새 cover glass를 얹은 후, tweezer로 살짝 눌러 잘 밀착시킨다.



- Linkam maintenance 황이 누적되기 전에 세척하여 유지합니다.



PVCam Test : CCD controller for contrast



PVCam Test (영상 및 contrast 이미지 얻을 프로그램)

1. CCD 전원 ON (프로그램을 먼저 킬 경우 Error)

- 2. Basic에서 파일 옵션 설정하기
- 3) 'Live (time-lapse)' 선택
- 4) Speed : '1 :10 MHz' 선택(MYO CCD) / RETIGA R6는 1:50MHz 고정
- 5) 샘플에 적당한 밝기에 맞춰 Exposure time 변경
- 6) 초당 촬영횟수에 맞도록 Time-lapse delay
 (10초 이상 예비 실행을 통해 아래 'Logs'창에서 명확한 fps 수치를확인할
 FPS: 1.5= 1초에 1.5 프레임씩 찍히는 것을 의미)

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	100	385	1.5
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	150	160	2.0

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[I] Sensor name: 'CSNAP-MYO'			
[I] Serial number: 'A15K846015'			
[I] Color mask: None			
[I] FITTIWARE VERSION: 10.35			
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PVCam Test : CCD controller for contrast



- PVCam Test (영상 이미지 얻을 프로그램)
- 7. Saving에서 저장 옵션 설정하기
 8) 'Do not save 클릭' Save as TIFF로 변경
 9) 노란색 폴더 버튼 파일 저장 위치 설정
- 10. Display에서 화면 옵션 설정하기
- 11) Zoom factor: 25% 선택
- 12) 체크박스 2개 모두 체크
- [주의] 'Saving'에서 저장 위치 등 옵션을 변경할 경우 자동 해제됨. 13) Start: 시작 / stop: 정지

[주의] Saving 중 Start를 다시 누를 경우, 이전 파일은 삭제됨.

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LDML Lab

iTools : Furnace temperature control

×

Remove

Add

1 to permitted range: 1 to 254

Scan

O Scan all device addresses (255 first, then 1 to 254)

O Connect via Series 2000 Interface Adapter (not CPI)

Note: overall performance is enhanced if scanning is stopped as

00

Access

×

254

Cancel



iTools (황 온도 조절 프로그램)

- Scan 1
- 2. ok
- 3. TIMER

4) Status – RES(0): 정지 / RES(1): 시작

5) TIMERSP1 – furnace 목표 온도 설정

6) TimerRamp1 – T/min (1분동안 올라갈 온도) 설정

(아래 T_{furnace}에 따른 T_s 표를 보고, 원하는 T_s 에 해당하는 T_{furnace} 를 입력해야함)

iTools

New File Open File

🖻 Browse 🔍 Find

File Device View Options Window Help

Parameter Explorer 📓 Watch/Recipe

10

Save

4

OPC Scope Enable Background Scan

Scan from device address

O Connect via CPI clip or IR cable

Scan for Eurotherm devices only

soon as possible

Discovery

protocol

Terminate Scan when first device found

No additional devices available via Discover

7. Device Panel: 클릭하면 아래의 온도 표시 창 보임 8) 황이 놓인 위치의 온도 (실제 황의 온도: T_s)

9) Furnace 정가운데 부분의 온도 (T_{furnace})

Τ _S (°C)	150	160	170	180	190	200	210	220
T _{furnace} (°C)	540	566	590	614	635	655	675	695
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T _{furnace} (°C)	712	730	750	762	780	795	810	825

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Scanning 8

Create new clone file

LDML Lab

Level 2 (Engineer)

3216 V2.13

LINKam : Sample ramping



LINKam (MoO₃/기판 온도 조절 프로그램)

- 1. USB 전원 ON
- 2. Controller
- 3. 'Connect USB' 클릭
- 4. Rate °C/min 설정 (주로 100 °C/min)
- 5. Limit °C 설정(CVD 목표 온도)
- 6. Time '1::' 설정(1:: = 1h)
- 7. '▶' 클릭하면 시작

(목표 CVD온도와 황온도를 고려하여 시작 시점을 계산. ex. CVD는 1분에 100 °C, furnace는 1분에 60 °C 올라가므로 T_{CVD}= 750 °C, T_S= 250 °C 온도 조건일 때는 furnace 온도 약 310 °C 지점에서 CVD온도를 올려야함.)





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Time(30min)

Ocam : Screen capture



Ocam (모니터에 보이는 전체 화면 녹화)

1. 메뉴

- 2. 옵션
- 3. 저장
- 4. 파일(MP4) 저장 위치 설정
- 5. 빨간색 녹화 버튼: 시작

(연두색 박스: 녹화 될 화면 부분 / 빨간색 박스: 녹화되는 중)





CCD Spec



Primary applications Fixed Cell Imaging Immunofluorescence Cell Trafficking FRET, FRAP, FISH Near-Infrared DIC Calcium/Ion Imaging



1940 x 1460 imaging array 4.54 x 4.54 µm pixels

The CoolSNAP MYO is a high resolution, high sensitivity camera for moderate to low-light life science applications. This unique cooled CCD provides 4.54µm pixel pitch, 14-bit digitization at 20MHz, enabling high spatial resolution and an optimized frame rate for time-lapse cell imaging. Its 2.8 Megapixels and a high Quantum Efficiency enables sensitive imaging with the option for binning for a higher dynamic range as well as increased signal-to-noise performance – all while providing an ideal pixel pitch for microscopy.



Qimaging Retiga R6 CCD Camera

Features	Benefits	
1940 x 1460 imaging array 4.54 x 4.54 μm pixels	High spatial resolution for imaging finer details	
High Quantum Efficiency	~75% peak quantum efficiency delivers high sensitivity	
20 MHz read out	High Speed readout to maximize temporal resolution	
USB 2.0 Interface	Easy connectibility and setup	
Binning	Increase frame rate and signal-to-noise performance	
14-bit digitization	Quantify bright and dim signals in the same image	
Thermoelectric cooling	Stabilized cooling produces a low dark current for long exposures	
Fan Disable Option	Disable the fan for vibration-sensitive applications	
C-mount	Easily attaches to microscopes, standard lenses, or optical equipment	
Acquisition software	Captures, analyzes, and saves high-resolution images	
PVCam® Driver	Support in a wide range of third party software packages Supported in Windows 7 64-bit/32-bit	

- CCD Array: 2688 x 2200 pixels (4.54um x 4.54um)
- Sensor Dimension : 12.5 mmx 10mm (16mm)
- Frame Rate: 7.1 fps (Full resolution), 12.8 fps (binning 2×2)
- 75% QE 효율 CCD Camera로 Extreme Low Light Imaging에 적합
- USB 3.0:50MHz high frame rate를 적용하여 이미지의 끊김 없이 포커스 조절이 가능하며, 빠르게 원하는 샘플을 찾을 수 있음

● Real-time FPGA의 알고리즘을 적용하여 깨끗한 영상 구현