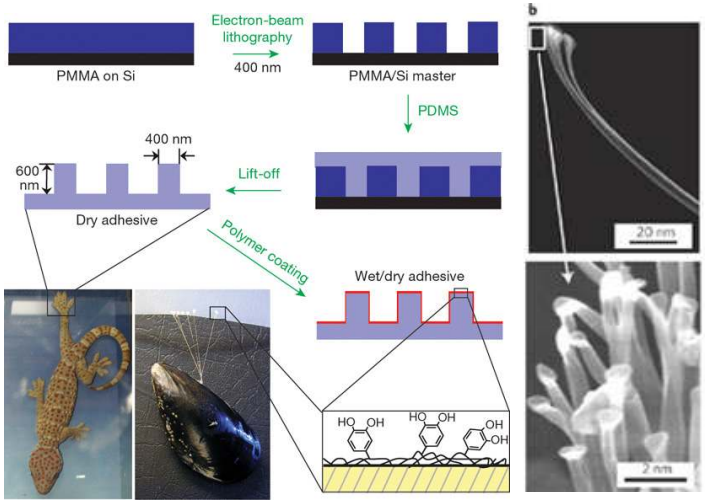
연구분야 5. 생체모방 마이크로 나노 디바이스 개발

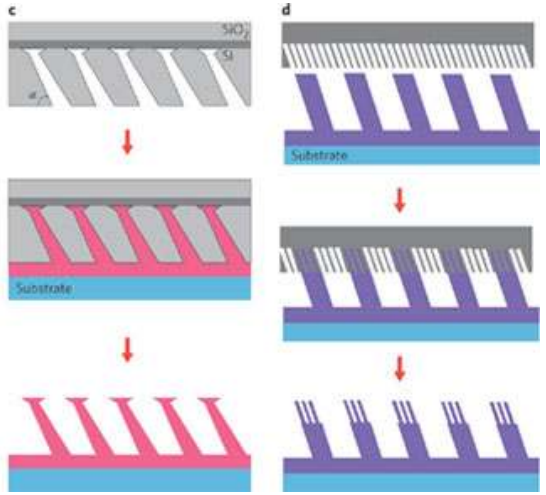
Biomimetic microdevices

Biomimetic system

K. Lau et al., *Nanoletter* 2003

Gecko foot hair





Haeshin Lee et al., *Nature* 2007

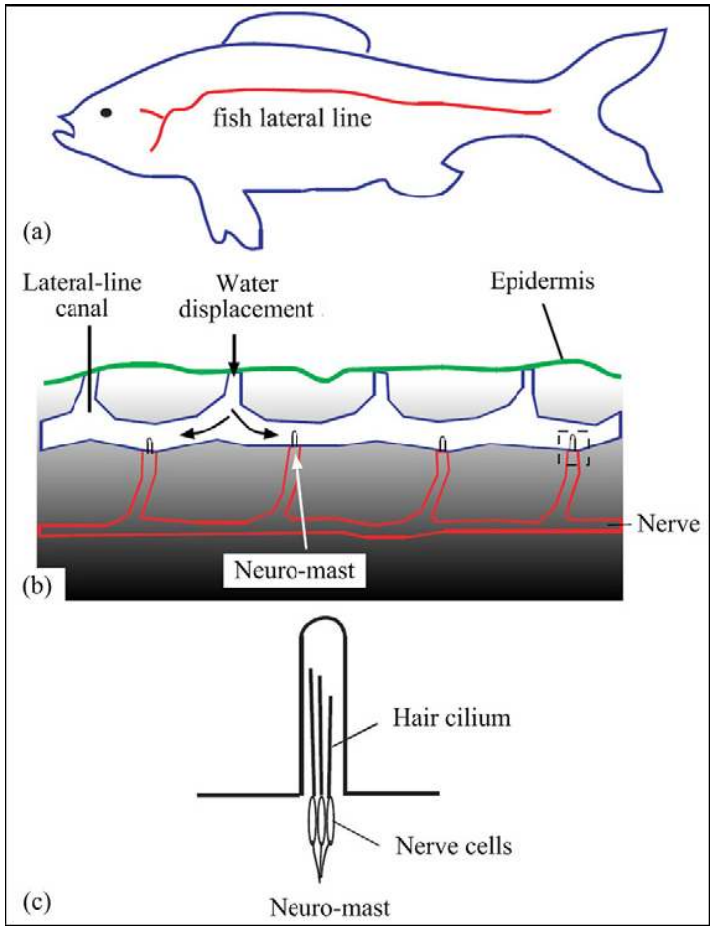
H. E. Jeong et al., *PNAS* 2009

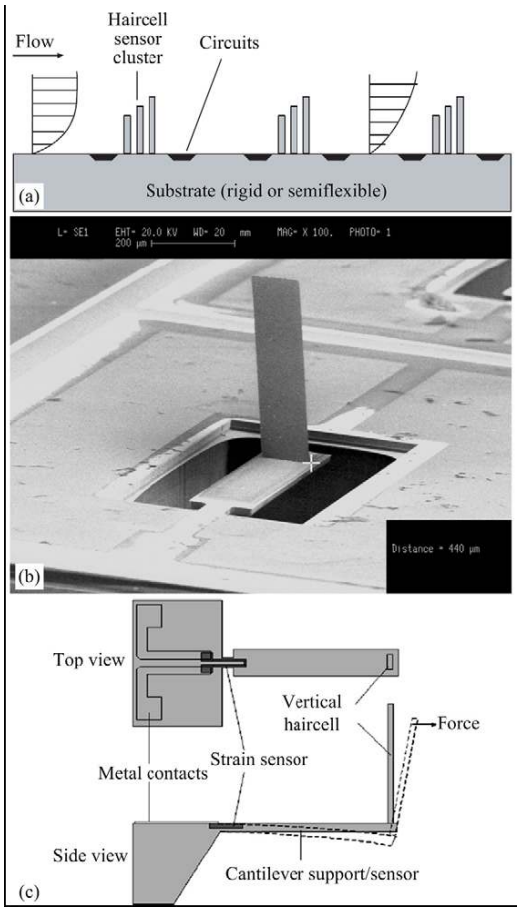
연구분야 5. 생체모방 마이크로 나노 디바이스 개발

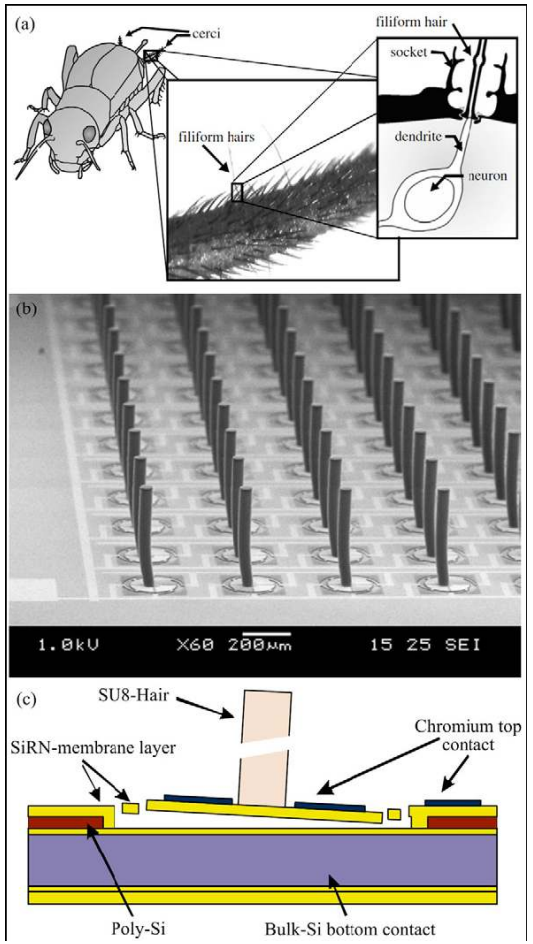
Biomimetic microdevices

Biomimetic system

Nano-Cilia: extremely sensitive sensor







Fan Z F et al., *J.Micromechanics Microengineering*,2002

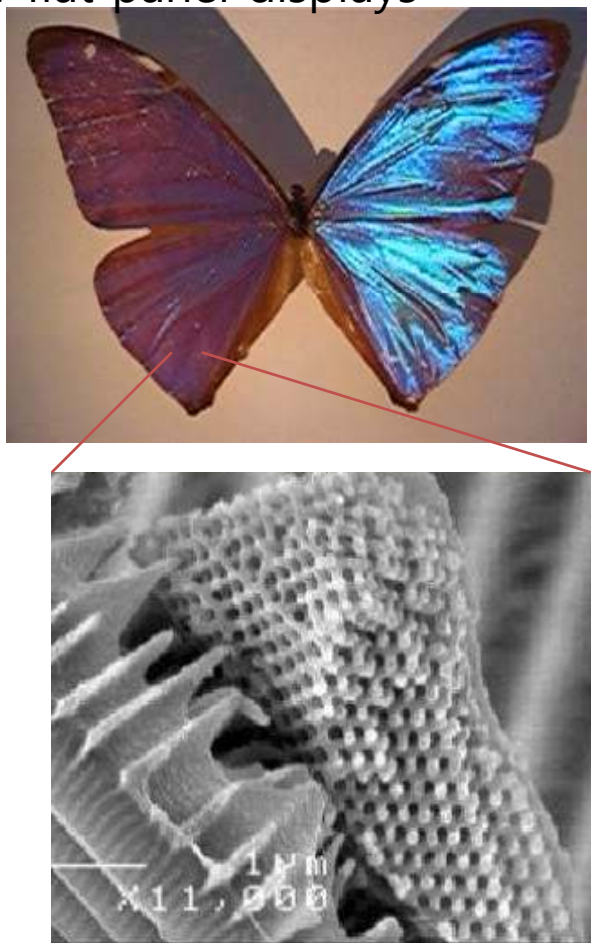
Krijnen et al., *Nanotechnology,* 2006

연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

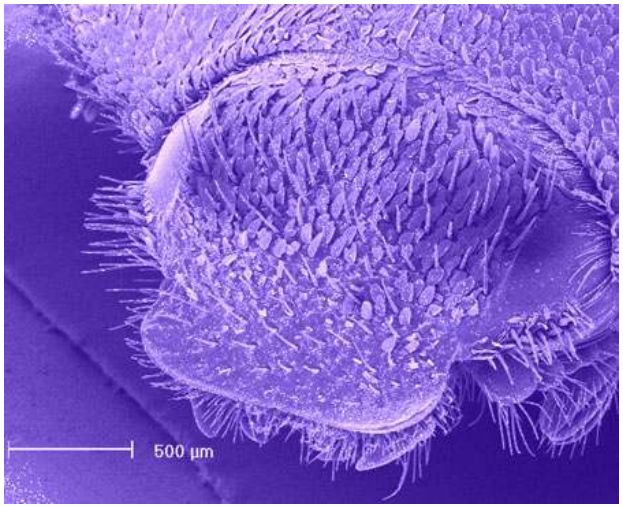
Biomimetic system

Butterfly wings may inspire new flat panel displays



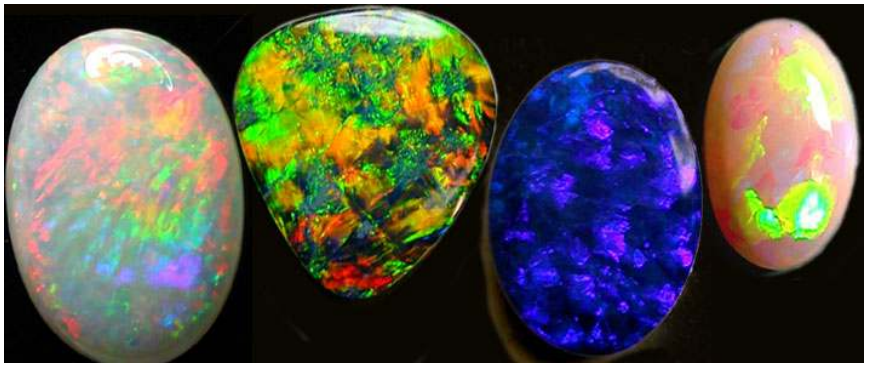
http://www.newscientist.com/

Beetle Photonic Crystal



http://www.aip.org/png/2005/243.htm

Opal

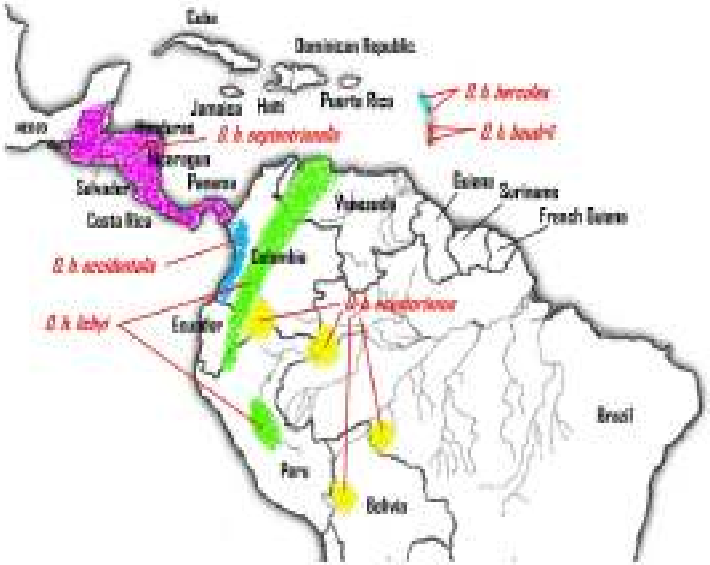


opalhouse.com

연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Dynastes Hercules



< Geographical distribution of *Dynastes hercules* >

Rassart, M. et al., *New Journal of Physics,* 2008

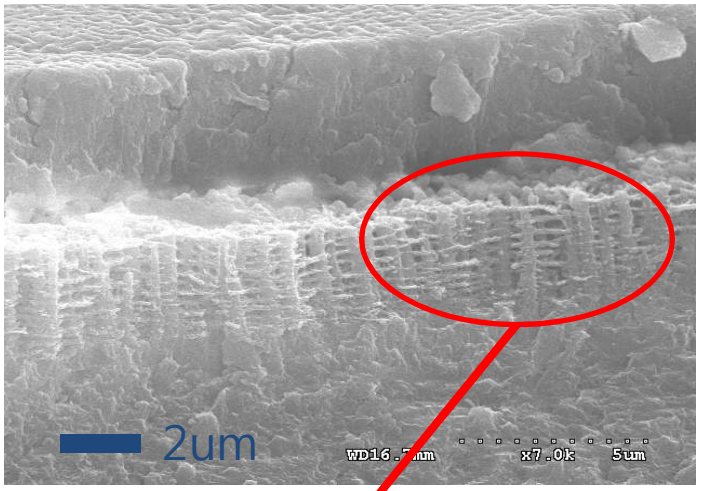
Dynastes Hercules appear khaki-green in a dry atmosphere and turn black

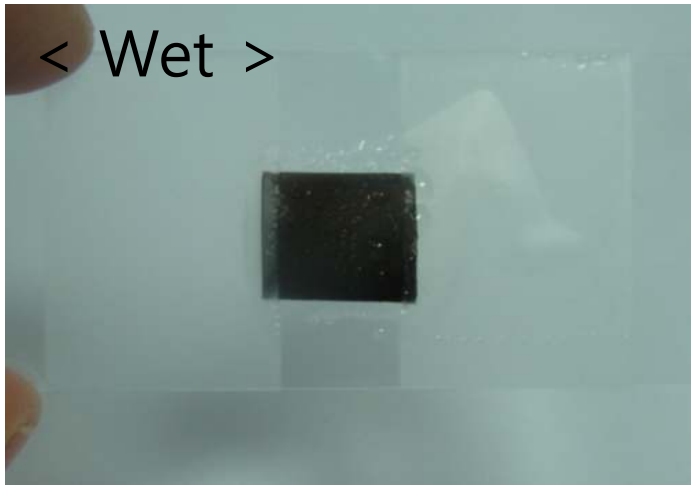
연구분야 5. 생체모방 마이크로 나노 디바이스 개발

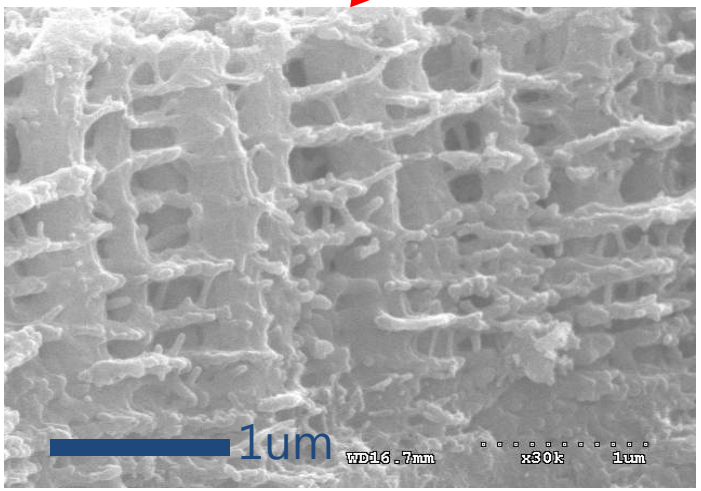
Biomimetic microdevices

Characterization of cuticle of Dynastes Hercules

Scanning electron microscope (SEM) images & picture



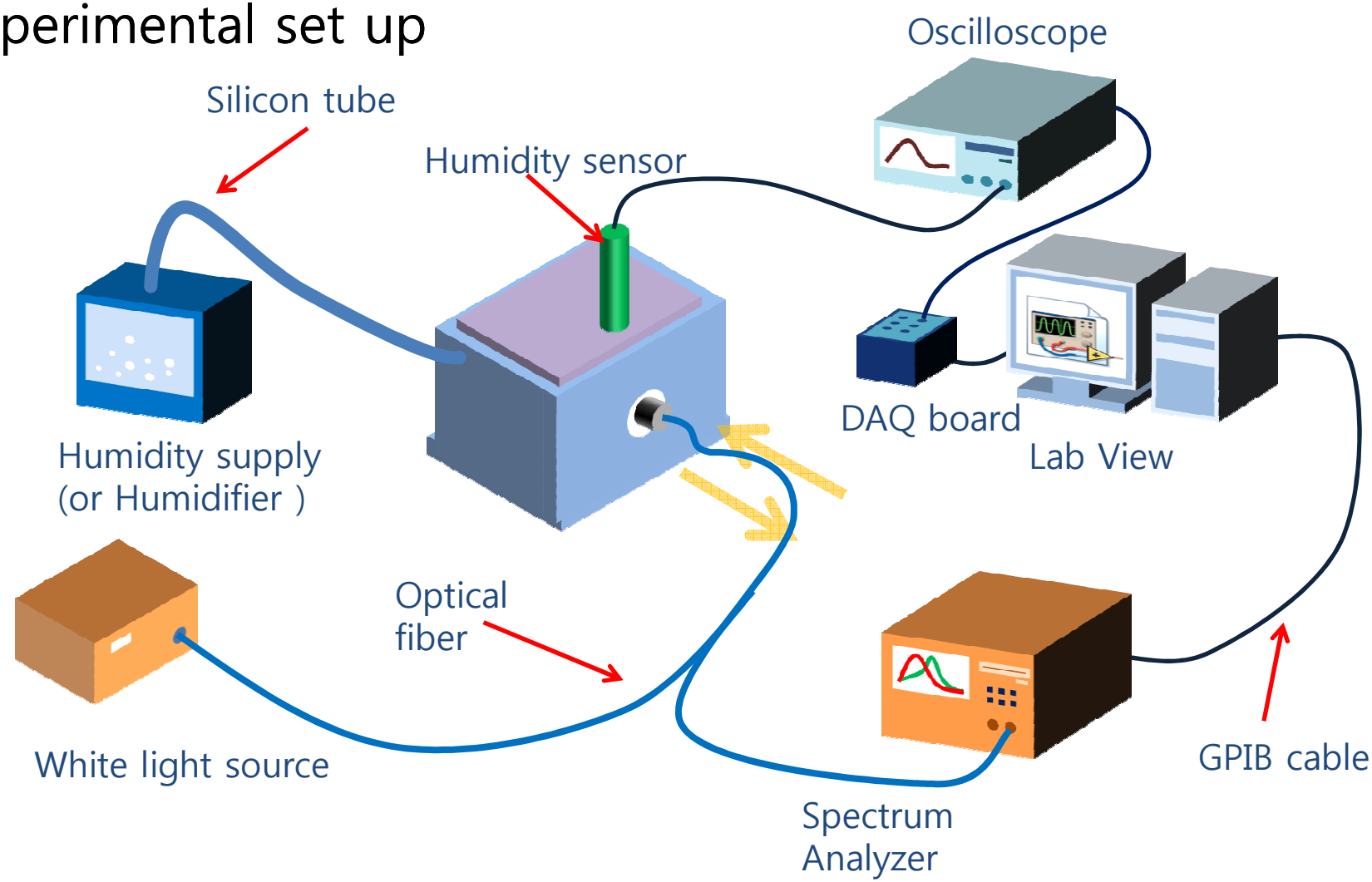




연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

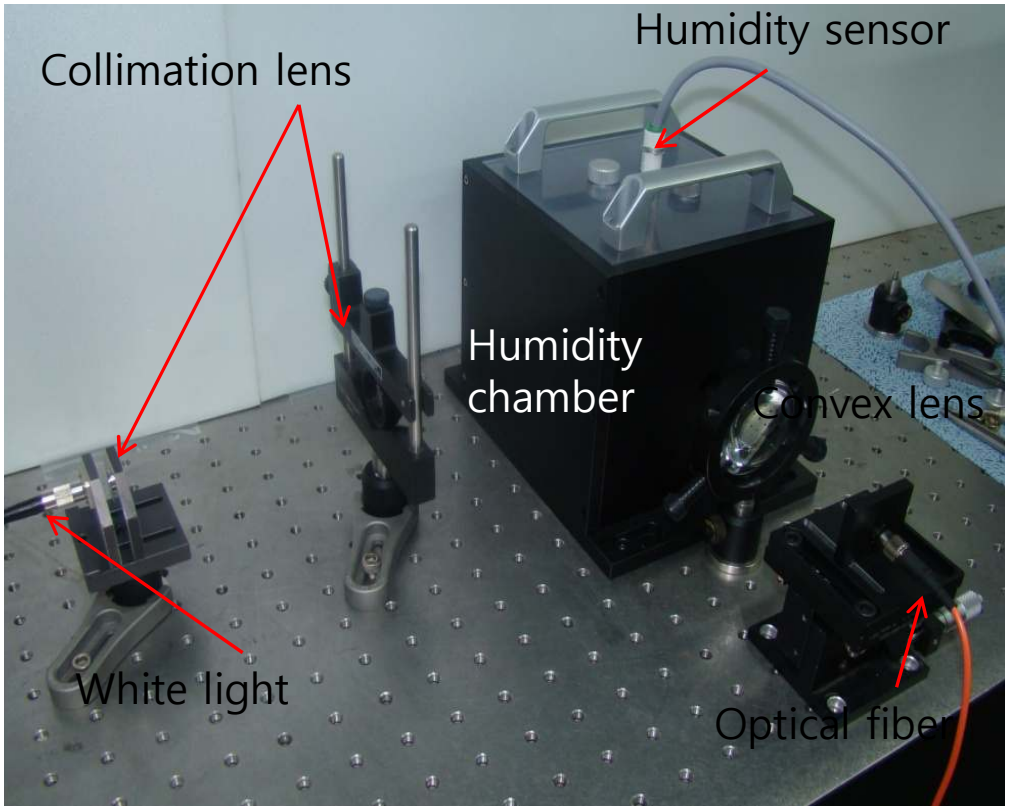
Experimental set up



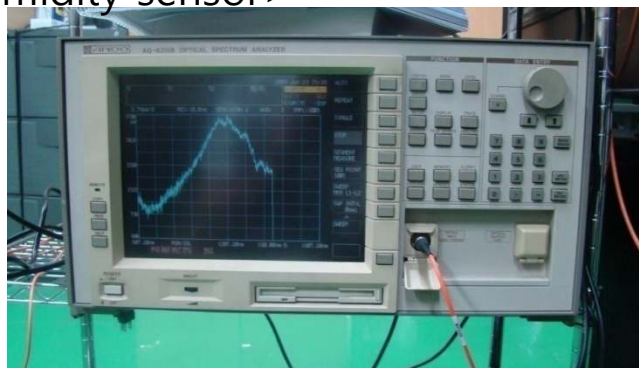
연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Experimental set up



< White light source & Conventional humidity sensor>

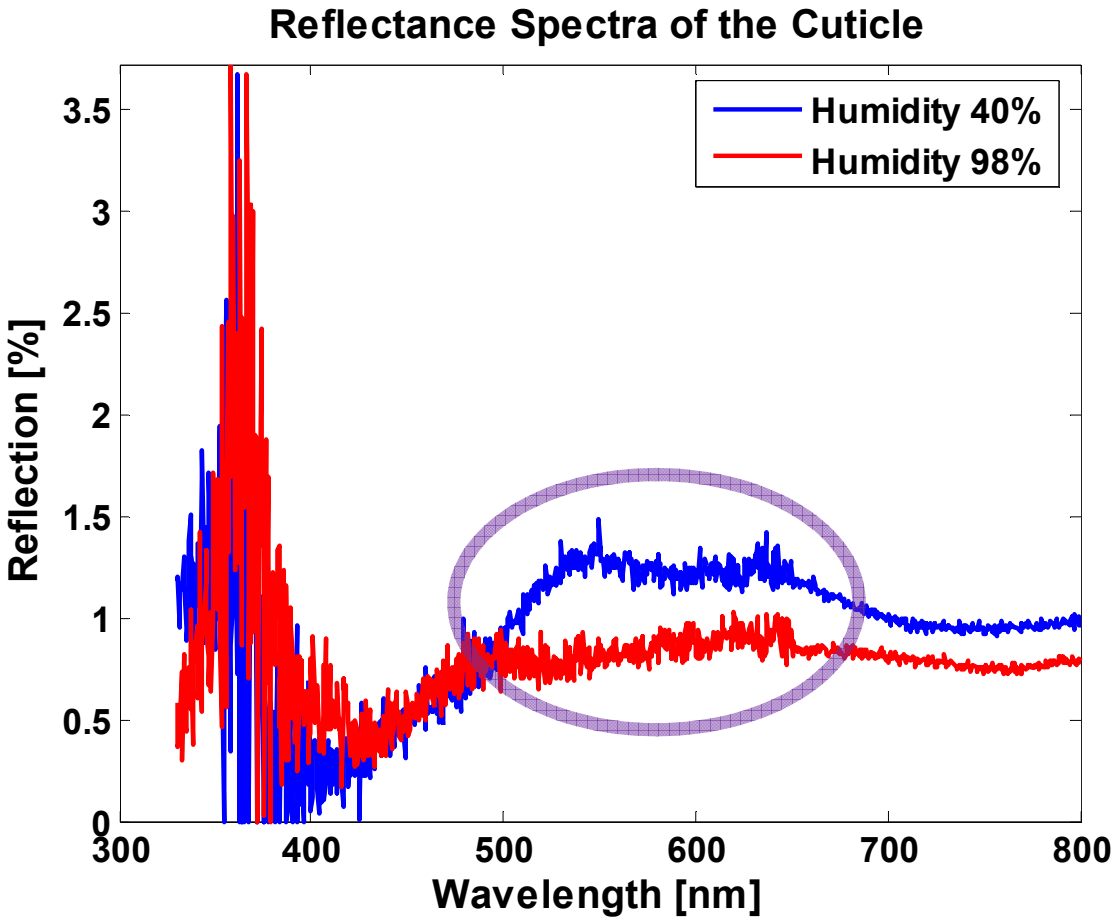


< Optical spectrum analyzer >

연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Spectral analysis of Dynastes hercules



Color	Wavelength(nm)
Violet	390 ~ 455
Blue	455 ~ 492
Green	492 ~ 577
Yellow	577 ~ 597
Orange	597 ~ 622
Red	622 ~ 780

연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

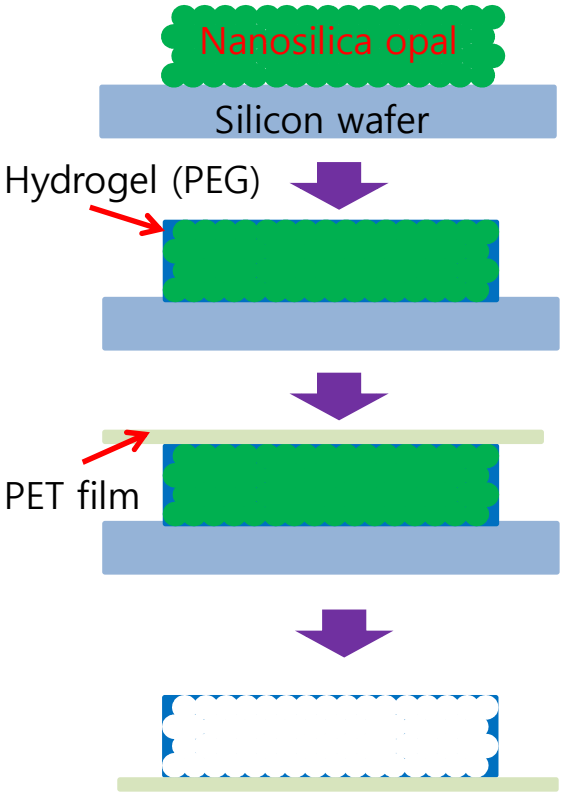
Fabrication process of humidity senor

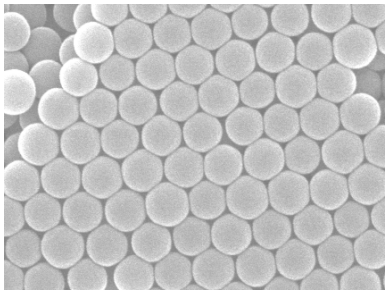
- Coating nanosilica opal film on silicon wafer

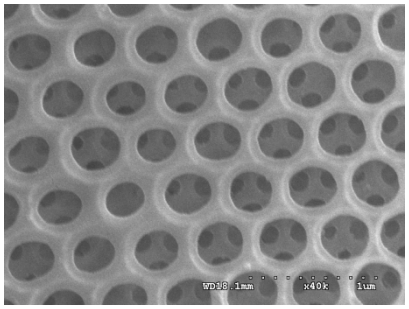
- Silica opal film is immersed into a PEG solution for 5min.

-Cover the sample with PET film and Expose to ultra-violet light

- Etching out silica colloids using BOE



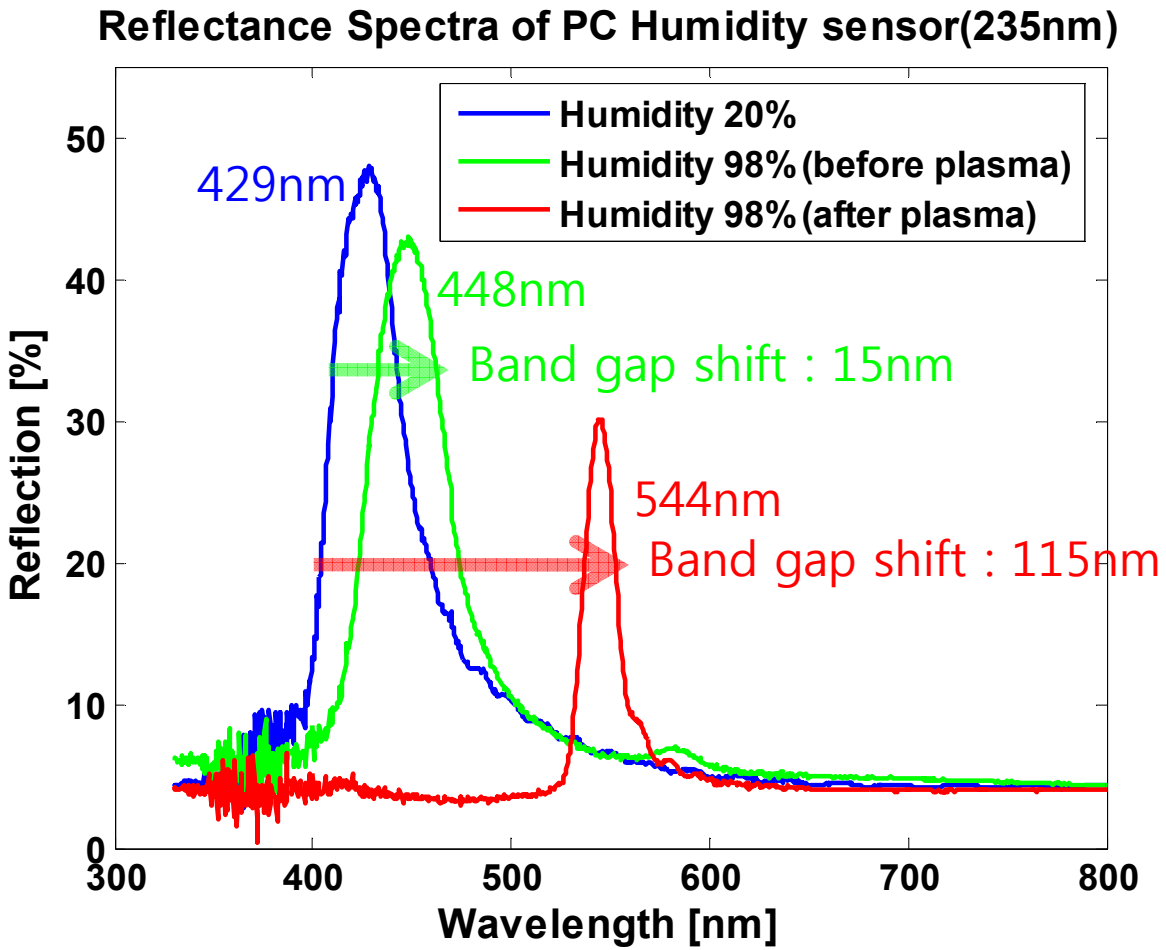




연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Spectral analysis of Photonic Crystal(PC) humidity sensor



Theoretical bandgap

$$\lambda_{dry} = 432.38nm$$

$$\lambda_{wet} = 526.04nm$$

Color	Wavelength(nm)
Violet	390 ~ 455
Blue	455 ~ 492
Green	492 ~ 577
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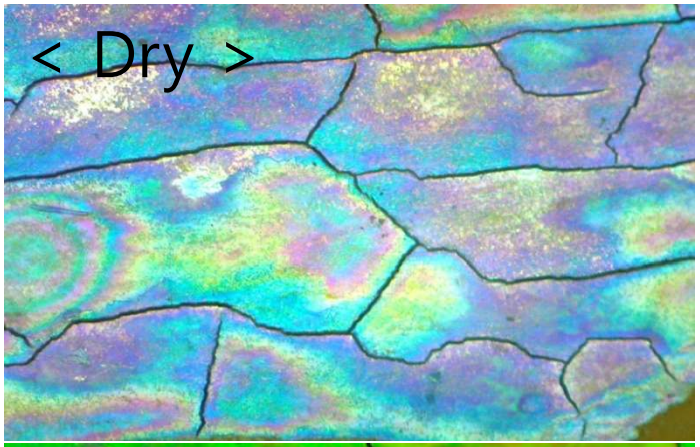
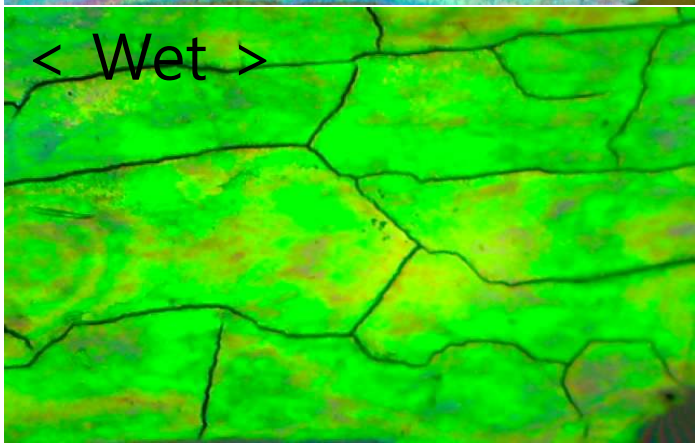
Red	622 ~ 780

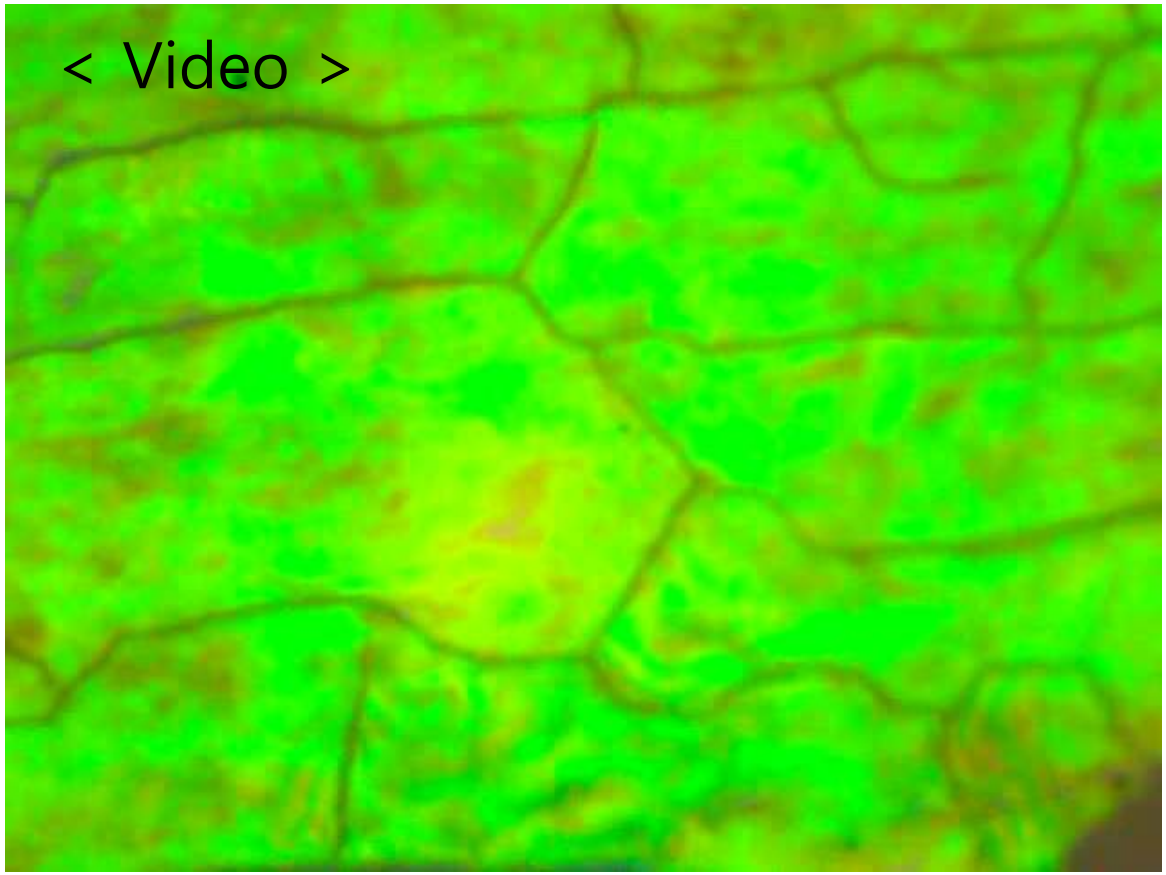
연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Color change of Photonic Crystal(PC) humidity sensor



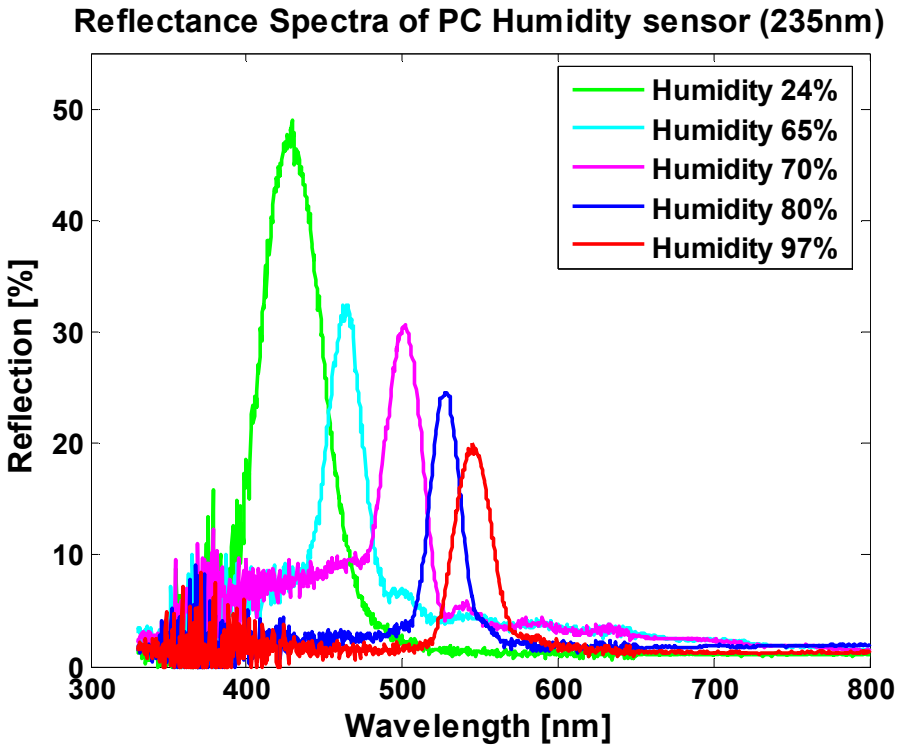


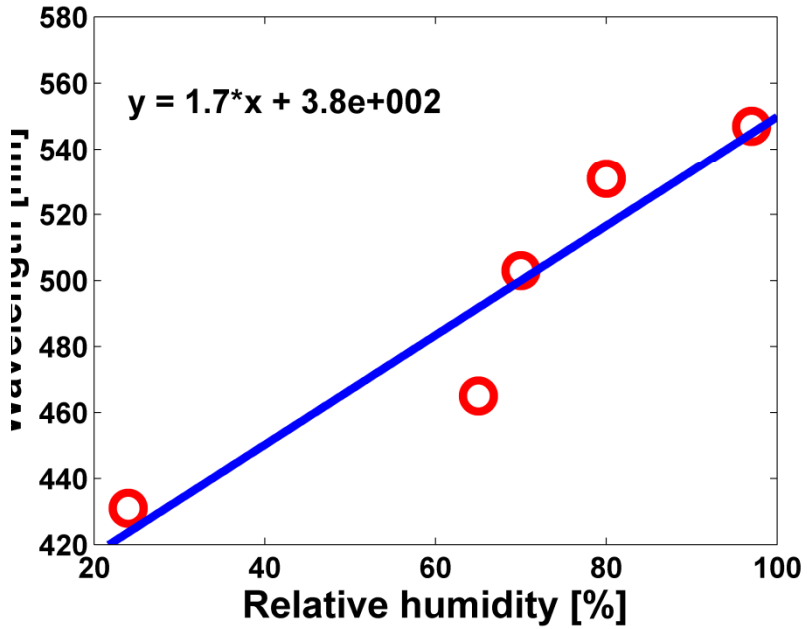


연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Performance analysis

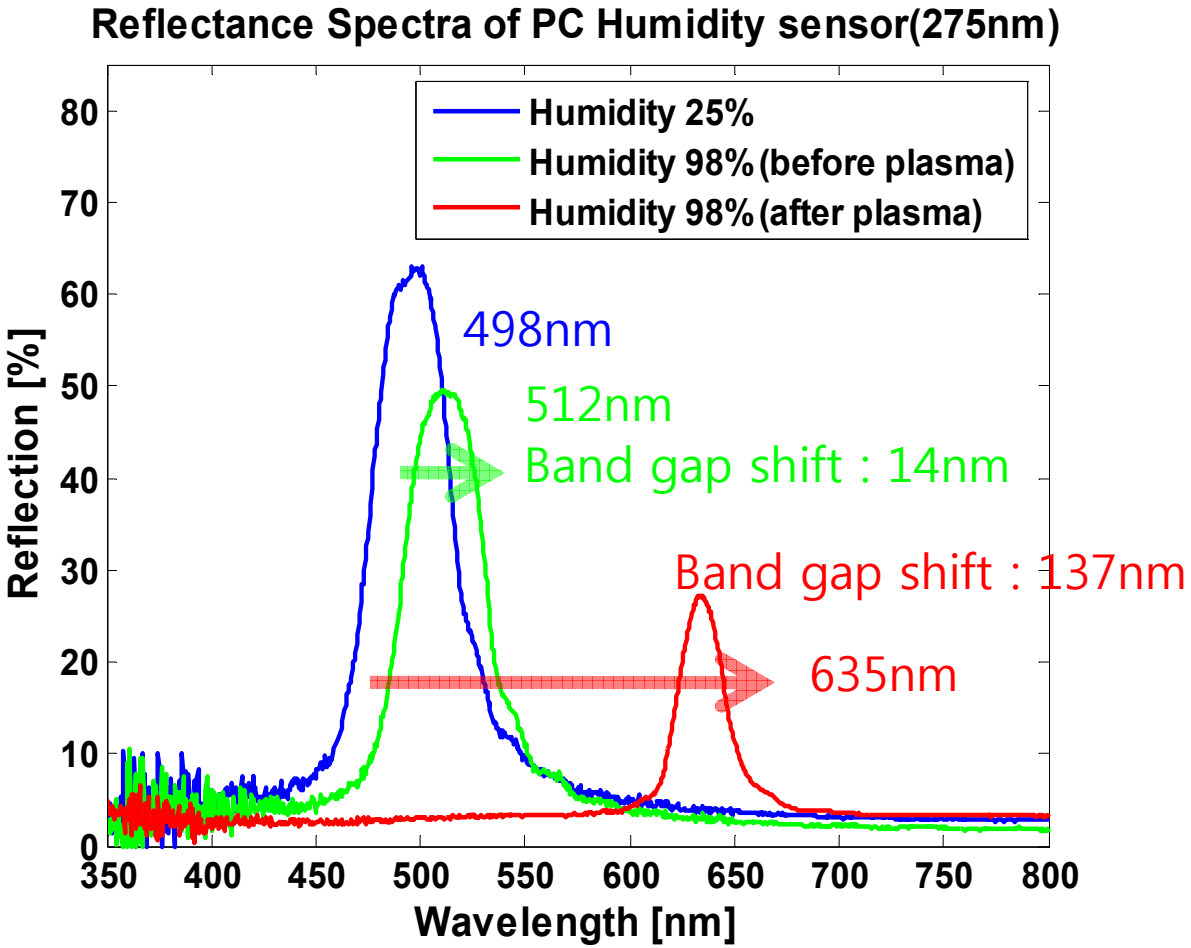




연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Spectral analysis of Photonic Crystal(PC) humidity sensor



Theoretical bandgap

$$\lambda_{dry} = 505.98nm$$

$$\lambda_{wet} = 615.57nm$$

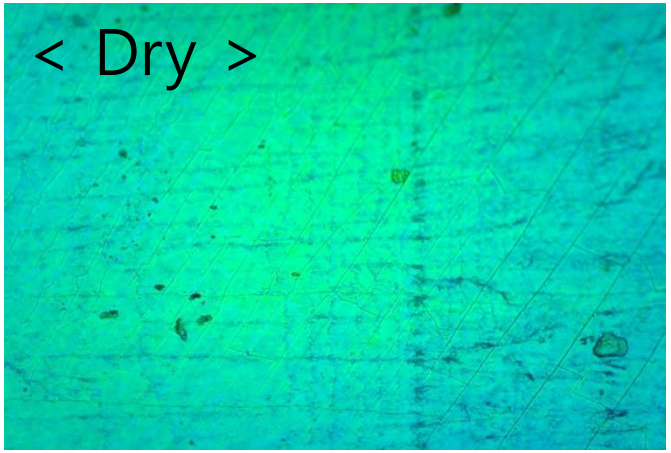
Color	Wavelength(nm)
Violet	390 ~ 455
Blue	455 ~ 492
Green	492 ~ 577
Yellow	577 ~ 597
Orange	597 ~ 622
Red	622 ~ 780

연구분야 5. 생체모방 마이크로 나노 디바이스 개발

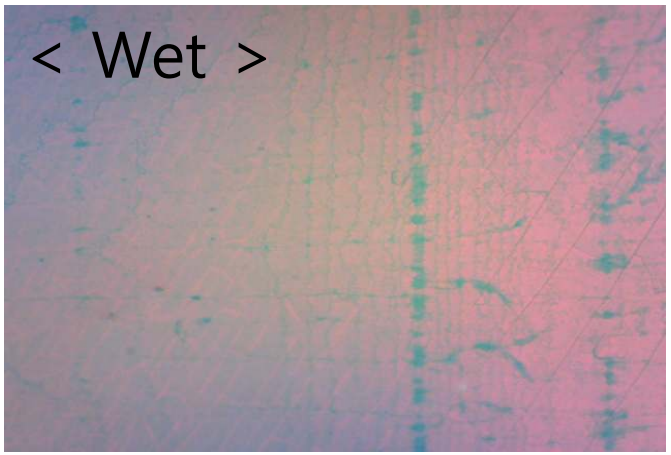
Biomimetic microdevices

Color change of Photonic Crystal(PC) humidity sensor

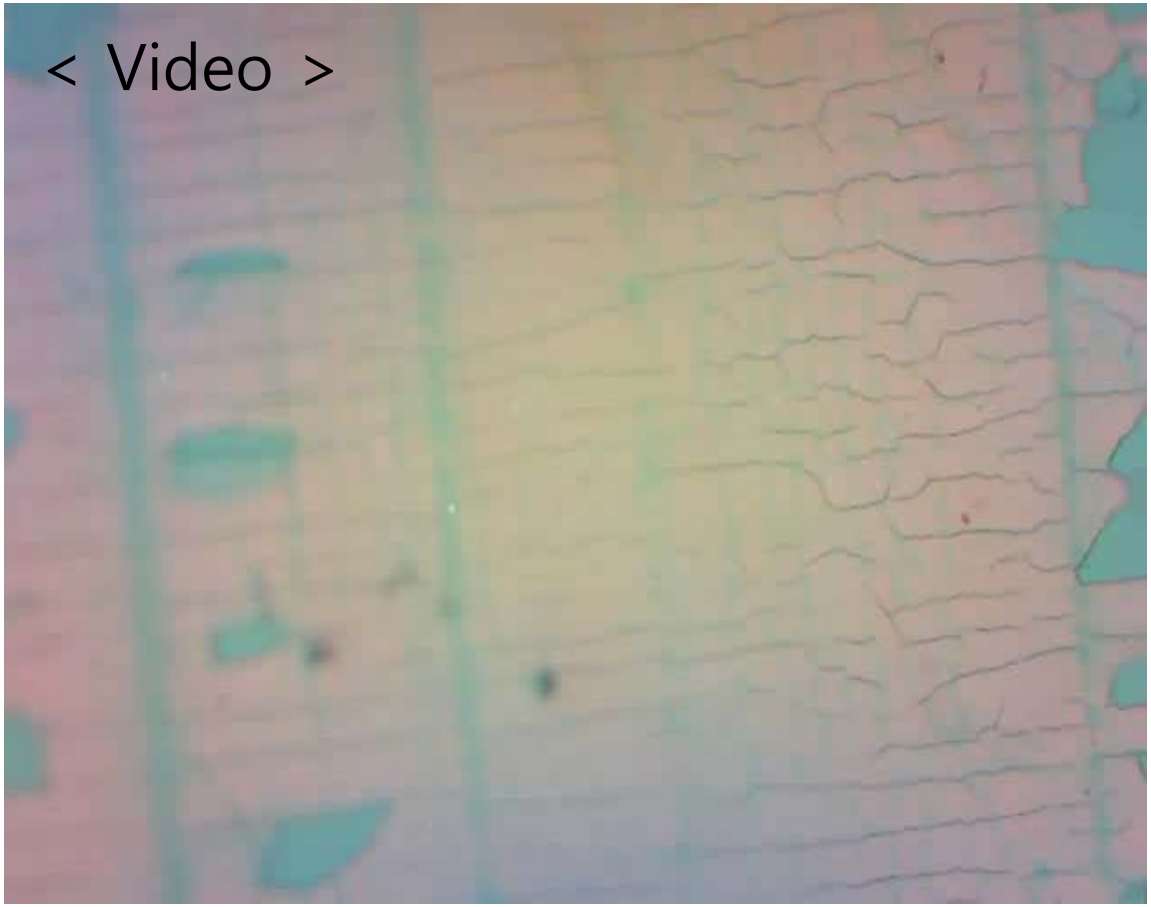
< Dry >



< Wet >



< Video >



연구분야 5. 생체모방 마이크로 나노 디바이스 개발

Biomimetic microdevices

Performance analysis