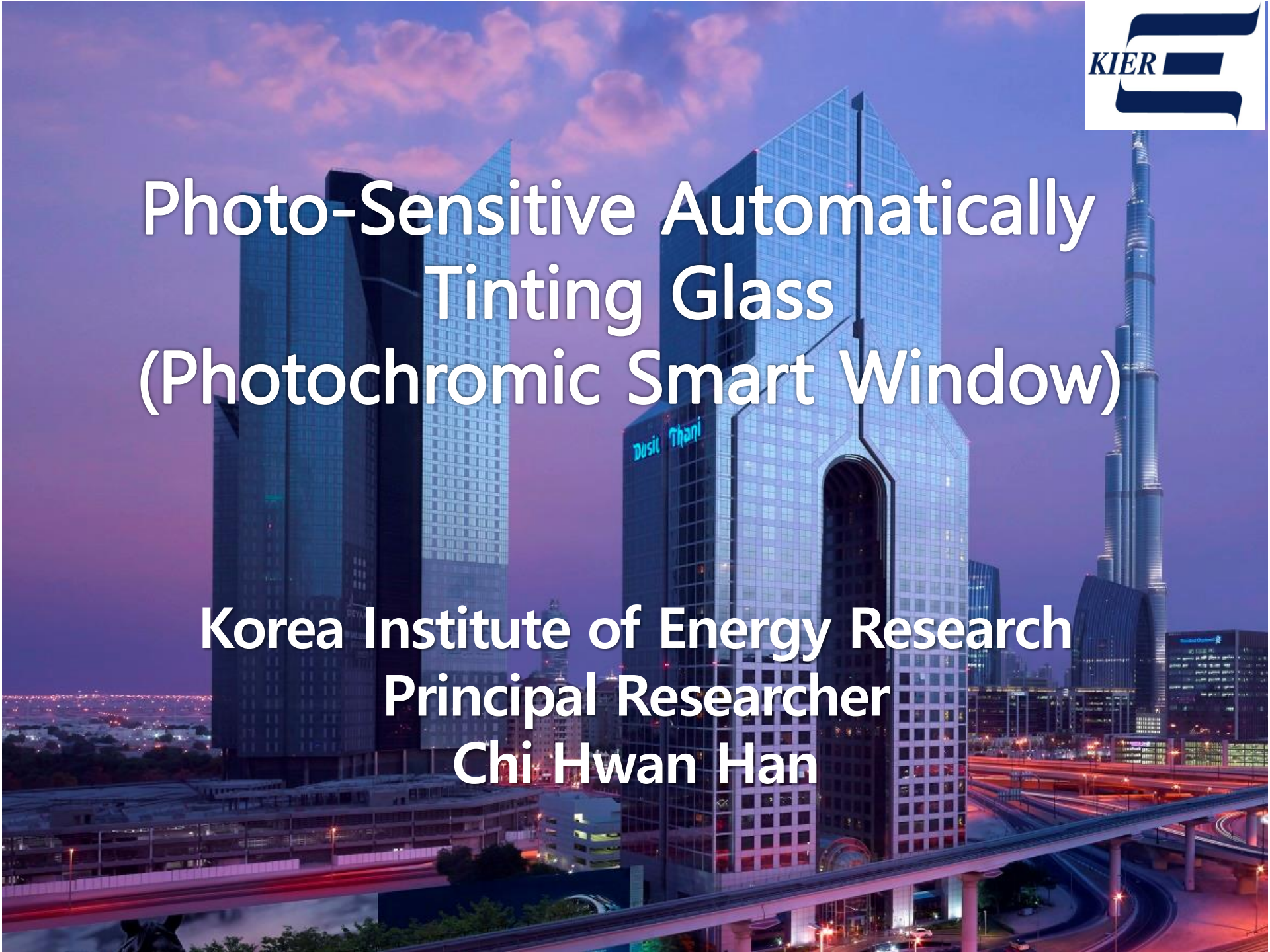


Photo-Sensitive Automatically Tinting Glass (Photochromic Smart Window)

Korea Institute of Energy Research
Principal Researcher
Chi Hwan Han

Buildings and Windows

Seoul Gwanak-gu office

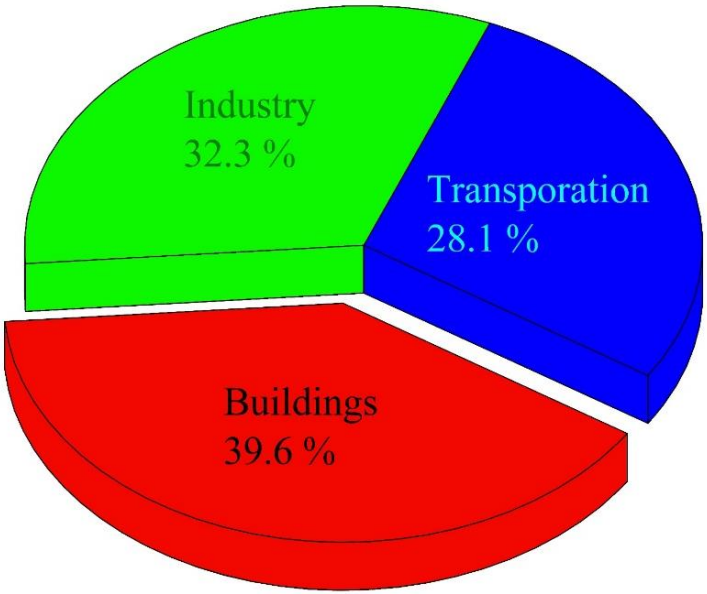
Busan, IPARK, Marine city

Lighting, Heating, and Cooling make up ~50% of the energy use in buildings

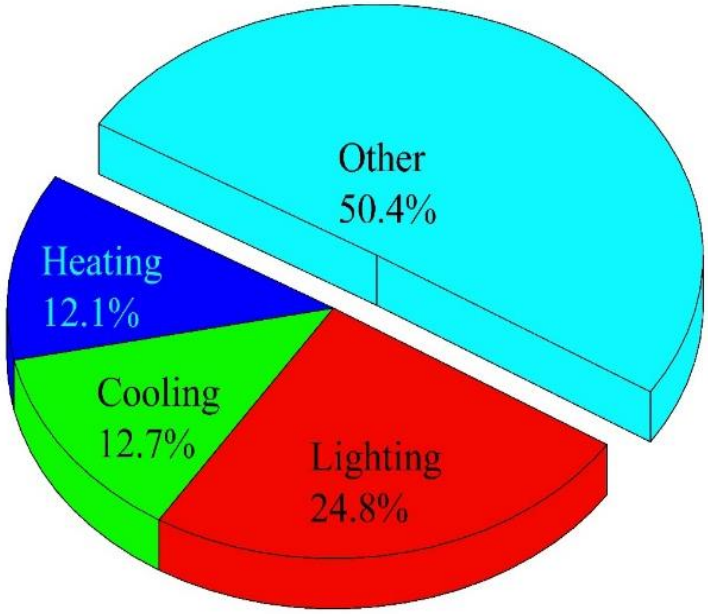
Energy Consumption in Buildings

KIER

U.S. energy consumption



Commercial Buildings



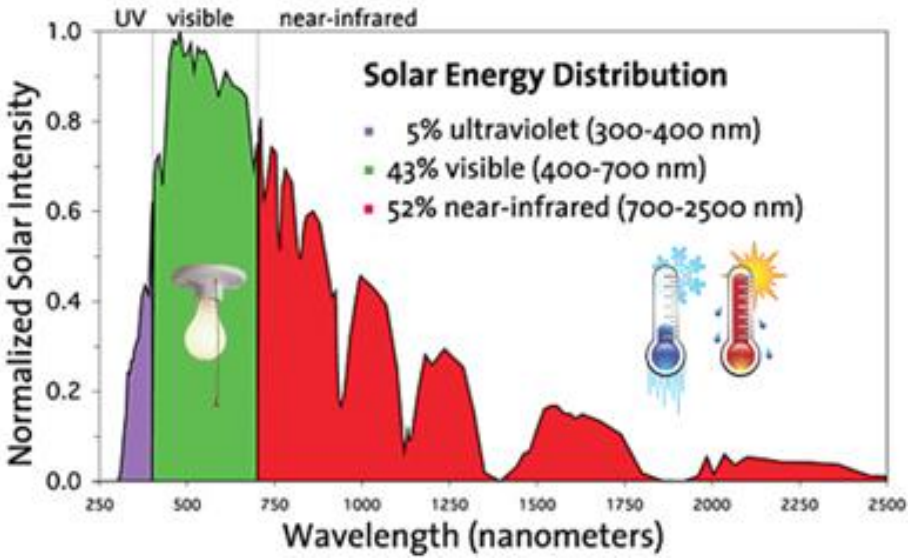
Lighting, Heating, and Cooling make up ~50% of the energy use in buildings

2011 Building Energy Data Book, U.S. DOE

$40 billion in electricity costs for heating and cooling of buildings in US

Sunlight on Building

Spectrum of sunlight



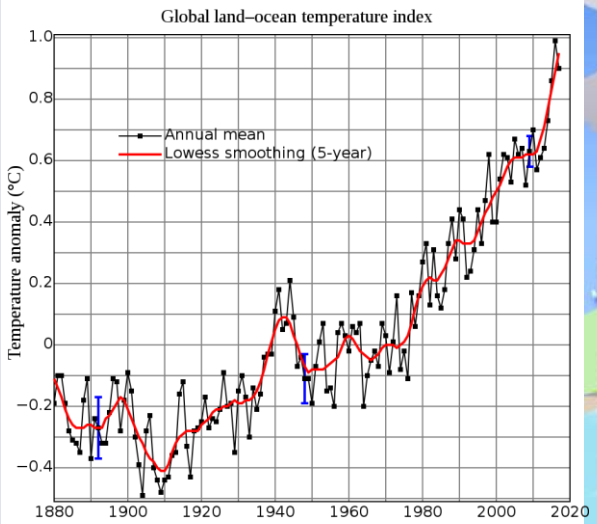
Infrared radiation

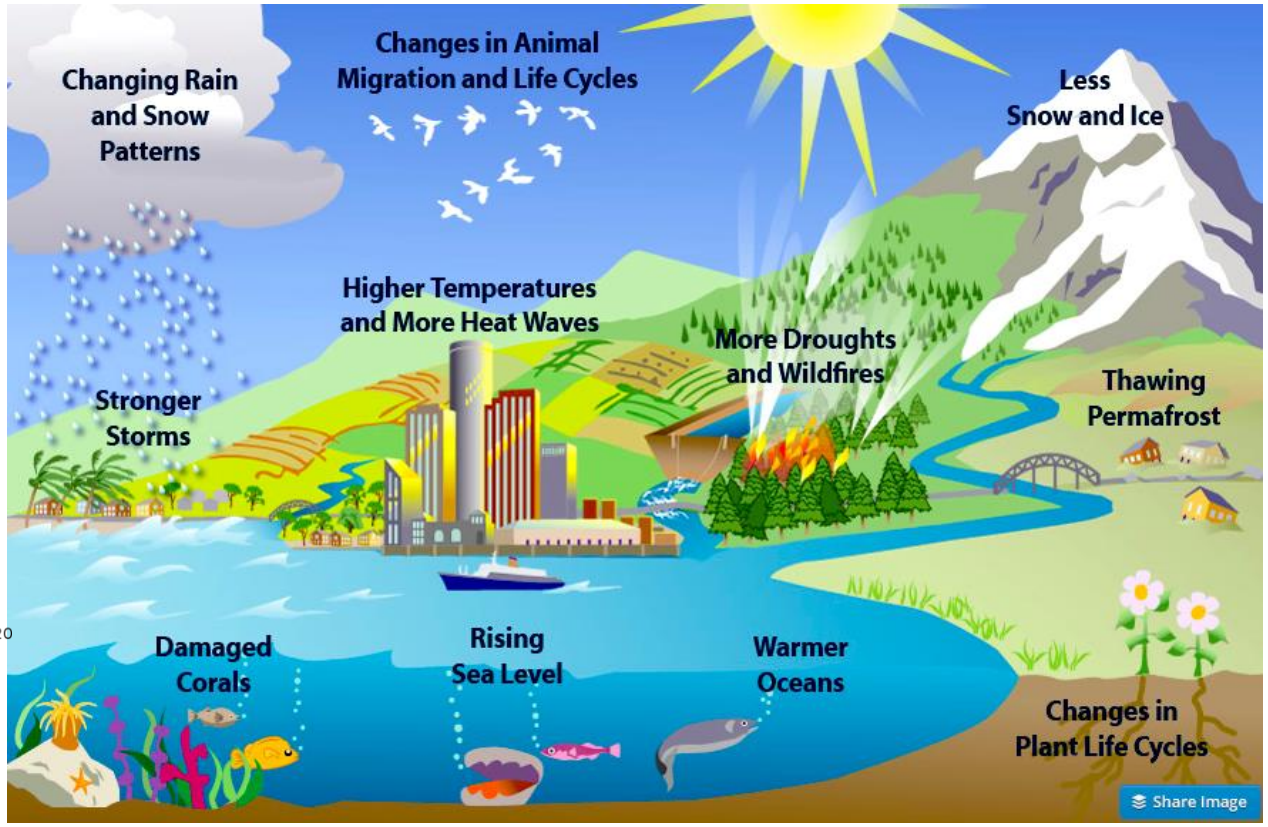
- regulate solar heat gain
- reduce energy used to heat & cool

Visible light

- regulate glare
- reduce energy for lighting

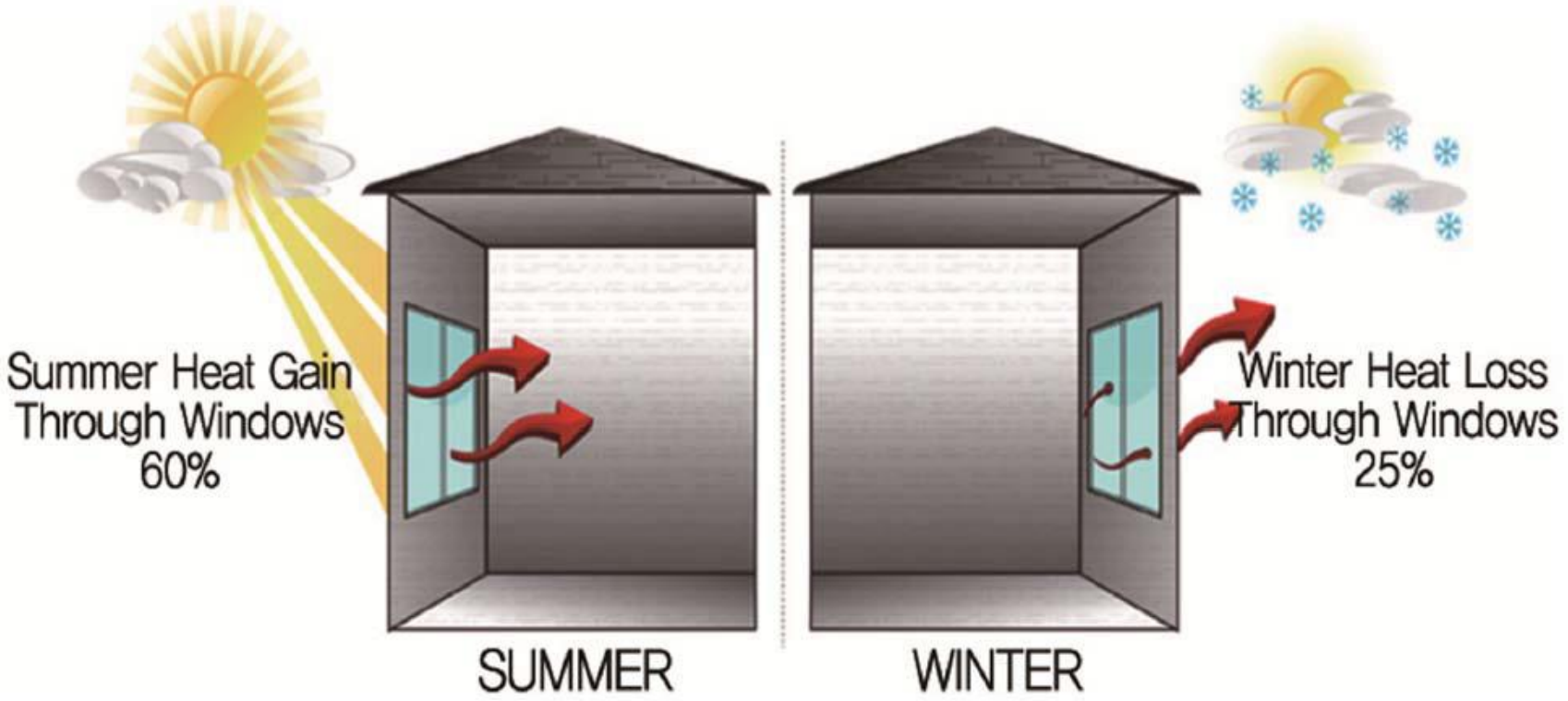
Global Warming (Climate Change)





Reference: Wekipedia Global Warming, Job One for Humanity home page

Window is Important

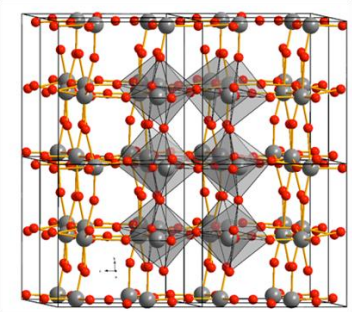


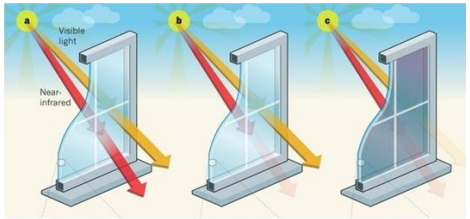
Smart Windows

KIER

Electrochromism

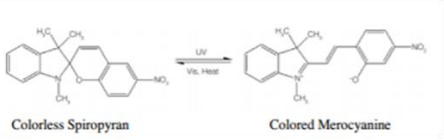
- High stability
- Active switching
- Slow switching speed





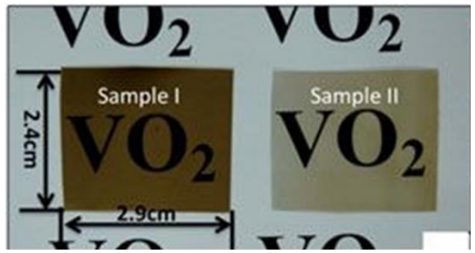
Photochromism

- Color change via UV light
- Fast switching speed
- Passive switching
- Poor durability

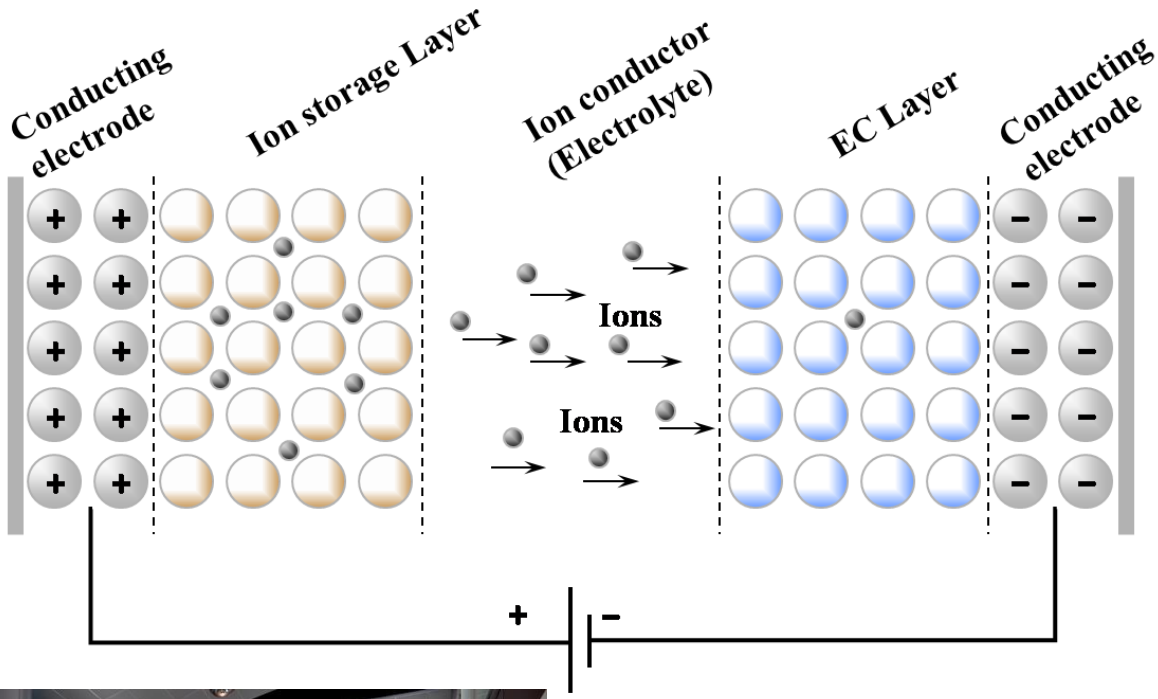


Thermochromism

- Color change via temperature increase
- Hysteresis
- Difficult to change transition temperature



Electrochromic Device (Smart Window)

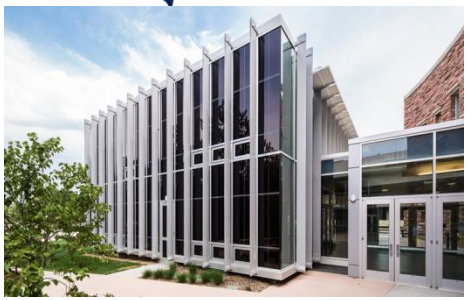


SageGlass®

Electrochromic Widow
Occupied Market

Sage Glass
Chabot College Hayward
Price : ~1,000 $/m^2

Electrochromic Windows by SageGlass



Colorado State University의 Morgal Library

Kimmel Center for the Performing Arts, Philadelphia

Immanuel Bible Church, Springfield, Virginia

TD Bank, Miami

Ajo Border Patrol Station, Why, Arizona

Saint-Gobain's Habitat Lab, Milan, Italy

Utrecht Government Building,
Utrecht, the Netherlands

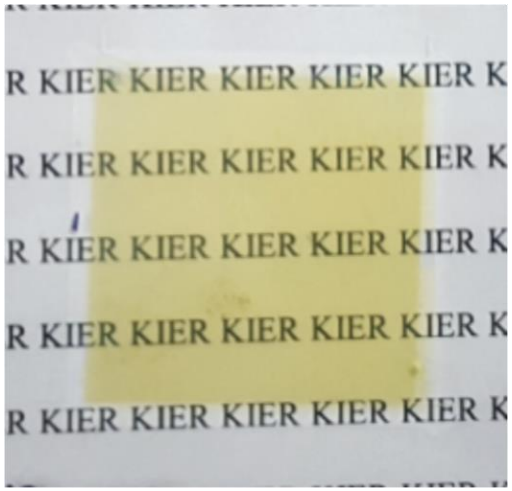
Chabot College, Hayward, California

UMB Financial Corporation, Scottsdale, Arizona

Reference: SageGlass www.sageglass.com/

KIER Photochromic Device

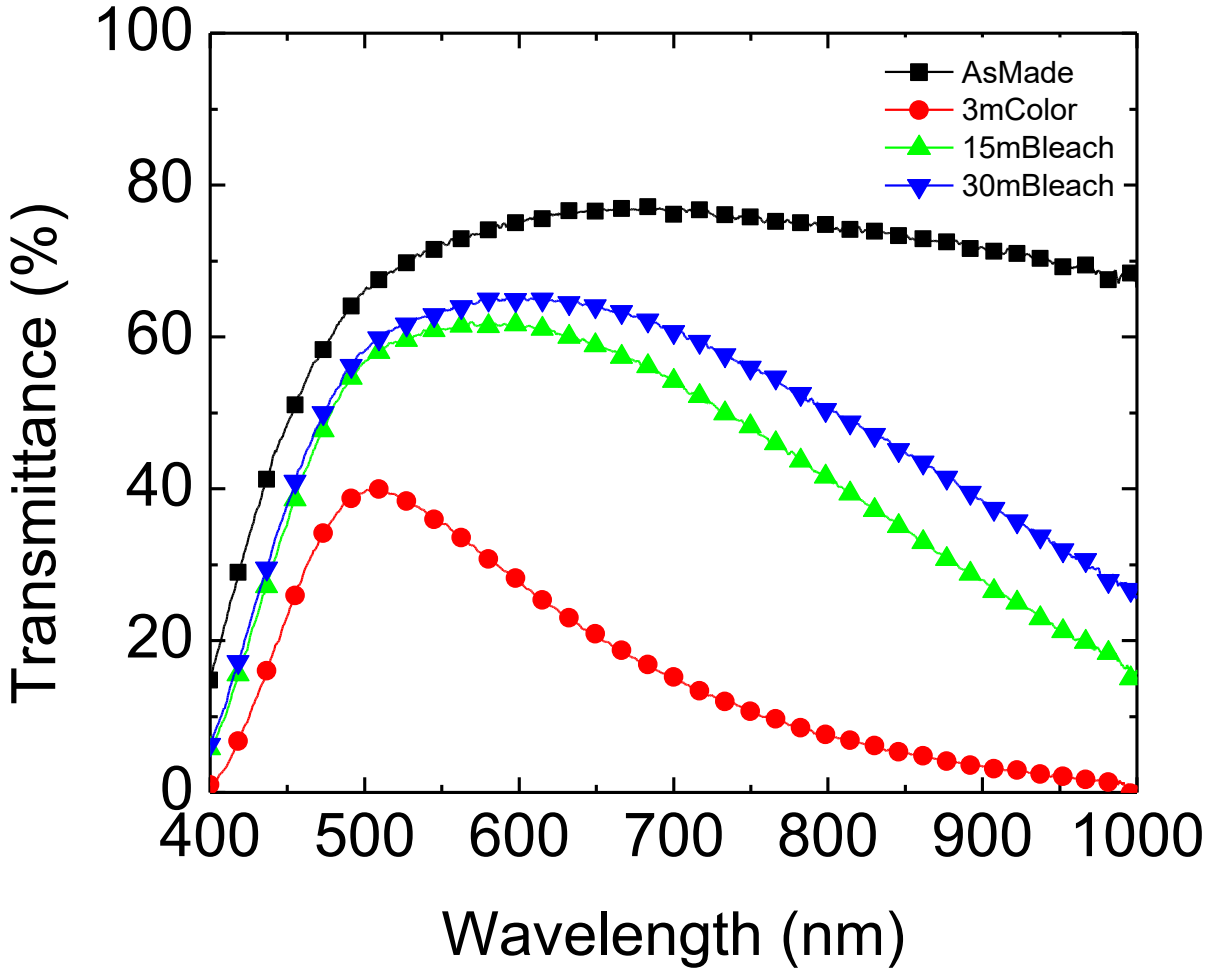
- **It is photochromic glasses that darken on exposure to sunlight. In the absence of sunlight, the glasses return to their original clear state.**
- **Our photochromic glass is pale yellow at its original state with average transmittance of 60% at 400 ~ 700nm. When it is exposed to sunlight, it turns to greenish blue and the transmittance of sunlight at 400 ~ 700nm can be reduced to around 15% and even more.**
- **Key merit of our photochromic glass is much cheaper manufacturing cost than electrochromic device even without external power supply to operate. Therefore, it can be adopted in both existing and new building much easier than electrochromic device as well as in the vehicles.**



Bleached State

Colored State

Transmittance

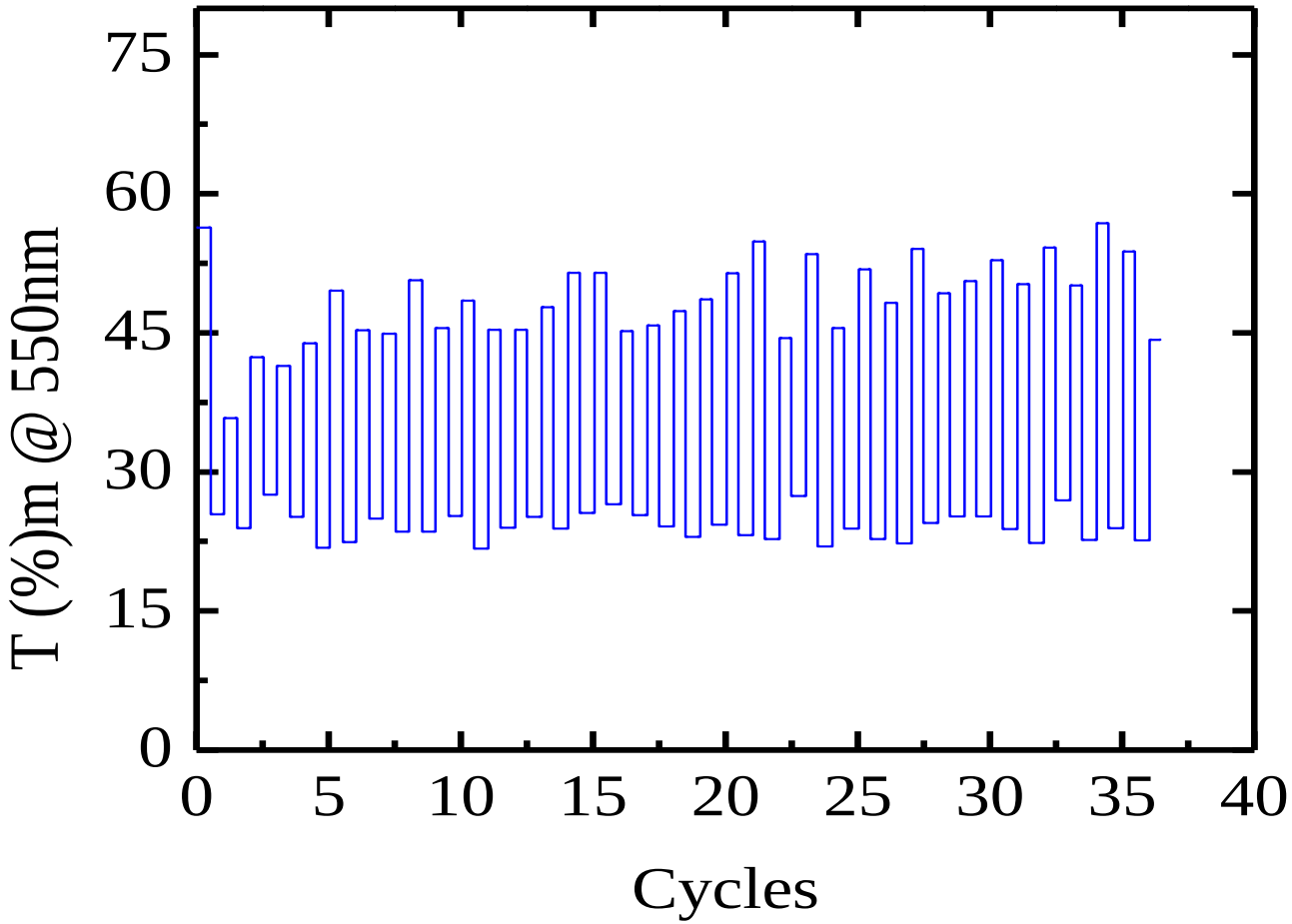


Coloring and Bleaching Time

Type	As Made	3 min	15 min Bleach	30 min Bleach
550	72.4	35.3	61.0	63.3
700	76.1	15.2	54.2	60.6

Cyclability

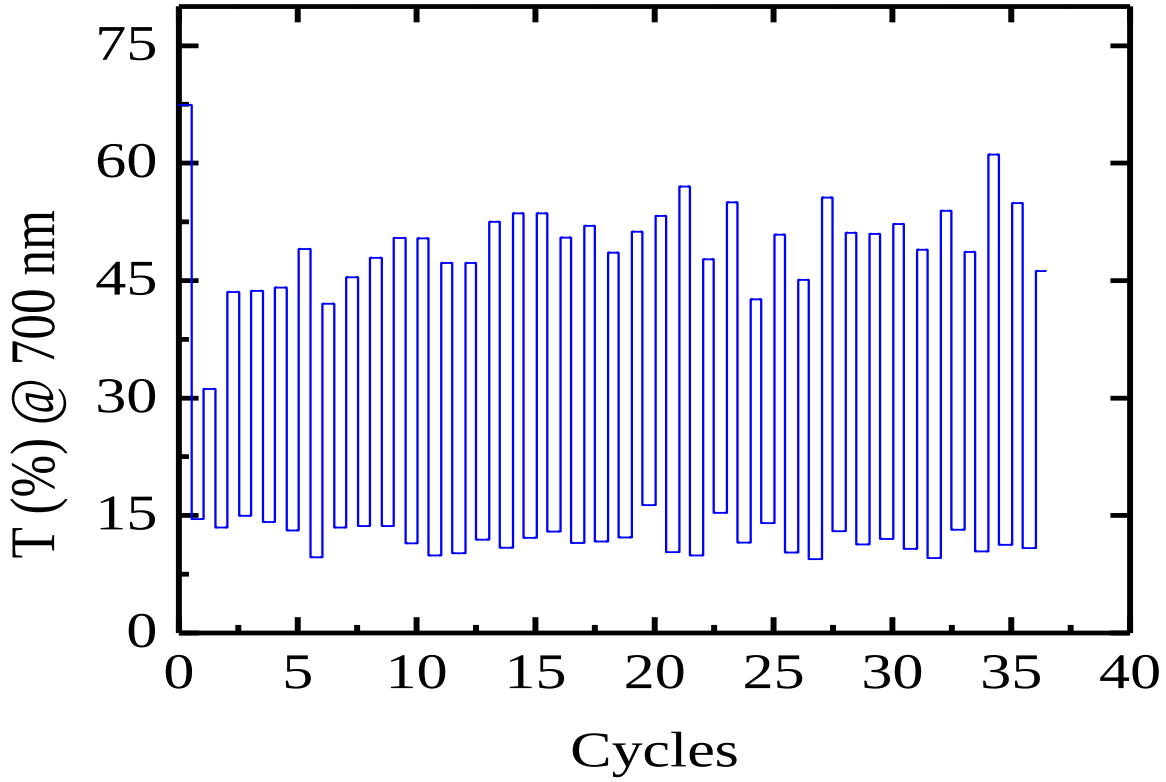
Coloring 2 min
Bleaching 15 ~ 150 min



- 100% of As Made after 150mins of Bleaching in Dark
- 89% of As Made after 45mins of Bleaching in Dark
- Lowest Transmittance : 21%

Cyclability

Coloring 2 min
Bleaching 15 ~ 150 min



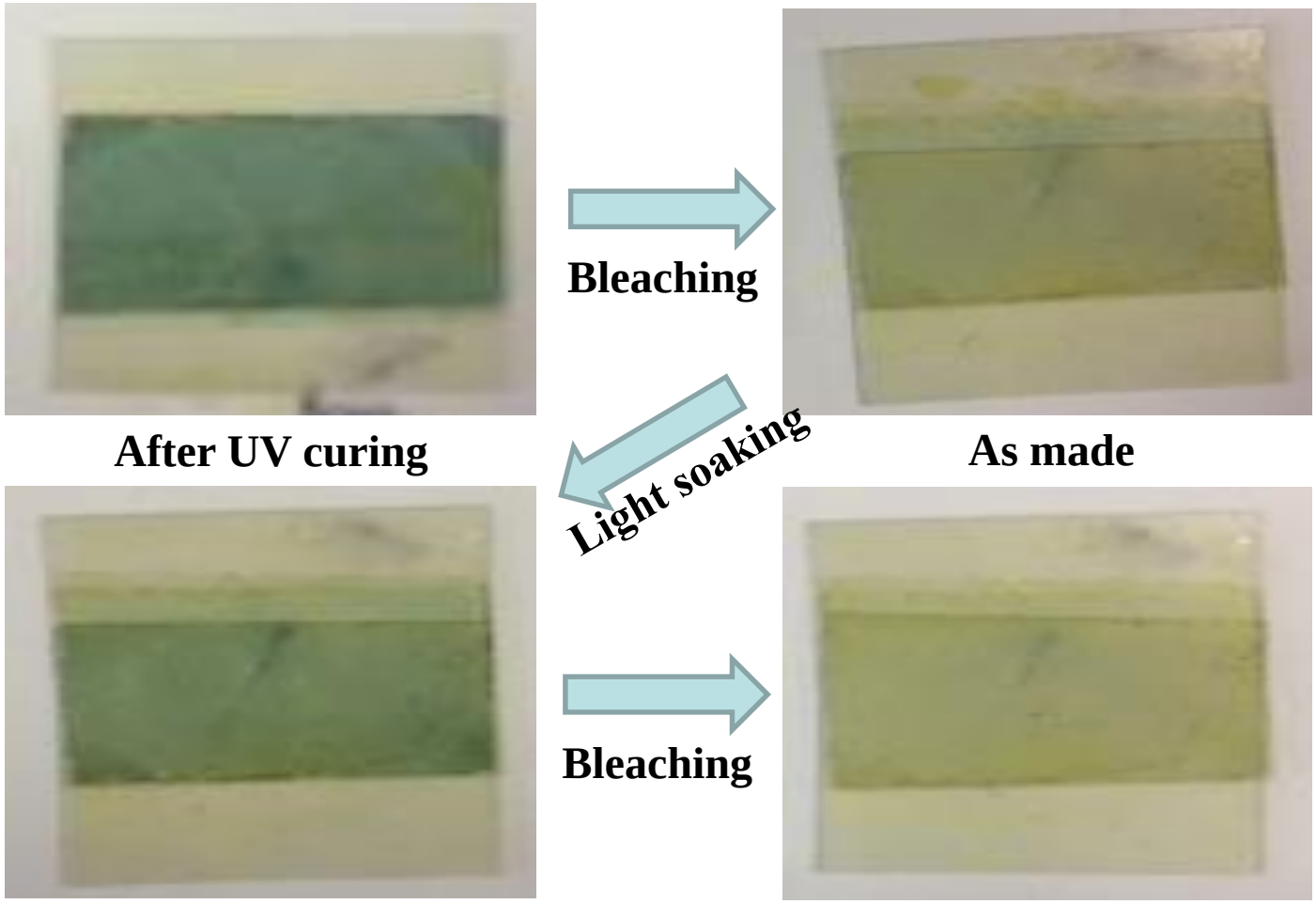
- 91% of As Made after 150mins of Bleaching in Dark
- 81% of As Made after 45mins of Bleaching in Dark
- Lowest Transmittance : 9%

Patterned Device

Bleached State

Colored State

Flexible Device



Thank You !!!

KIER

www.kier.re.kr