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EB PPT

Xincun Dou

BIOGRAPHY

Xincun Dou, male, born in May, 1981, PhD, professor of the Xinjiang Technical Institute of Physics & Chemistry, Chinese Academy of Sciences (CAS). He got his bachelor's degree from East China Normal University in 2004. Since obtained his doctor's degree in materials physics and chemistry at Institute of Solid State Physics, CAS in 2009, he has been working in the same institute as an assistant professor till Jul, 2011. During the period of Nov 2009 to Nov 2011, he worked as a research fellow at Energy Research Institute @ NTU, Nanyang Technological University. In Jul 2011, he got his current position. He was engaged in high performance new materials related to energy harvesting and environment protection, such as thermoelectric materials, solar energy harvesting materials, photocatalyst etc. And at the same time to understand the underlying mechanisms. The device performance is of particular interest. He has authored more than 30 research articles and one book chapter. He has been honored as "Excellent president award of CAS" and "Excellent young scholar award" in C-MRS previously.

Research Interests

Thermoelectric materials, solar energy harvesting materials, photo catalyst etc.

PHOTO CATALYST

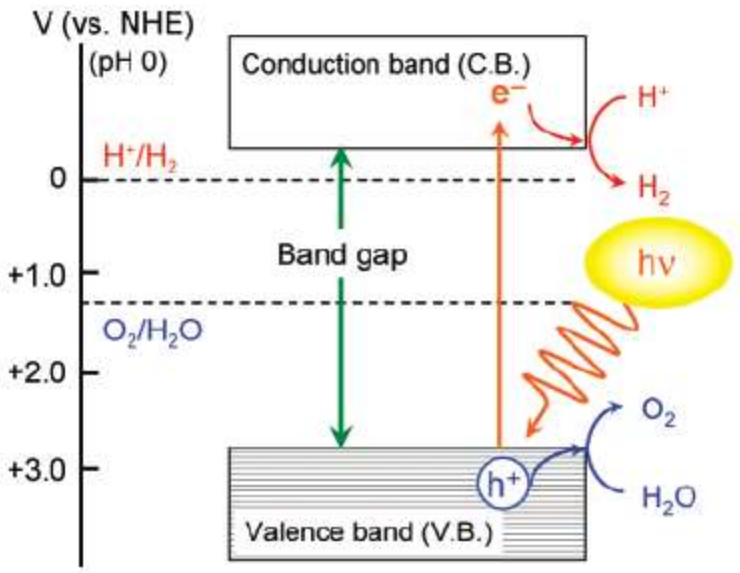
- It is a process by which a photochemical alteration occurs in one molecular entity as a result of initial absorption of radiation by another molecular entity called the photosensitized.
- Chlorophyll of plants is a type of photocatalyst
- The difference between chlorophyll photocatalyst to man-made nano TiO_2 photocatalyst (here below mentioned as photocatalyst) is, usually chlorophyll captures sunlight to turn water and carbon dioxide into oxygen and glucose, but on the contrary photocatalyst creates strong oxidation agent and electronic holes to breakdown the organic matter to carbon dioxide and water in the presence of photocatalyst, light and water.

Photocatalyst material requirements

- **Band gap**: Band gap>1.23eV and sufficiently small to make efficient use of solar spectrum (~<3eV). Band levels suitable for water splitting.

- **High Crystallinity**: Defects can act as recombination sites.

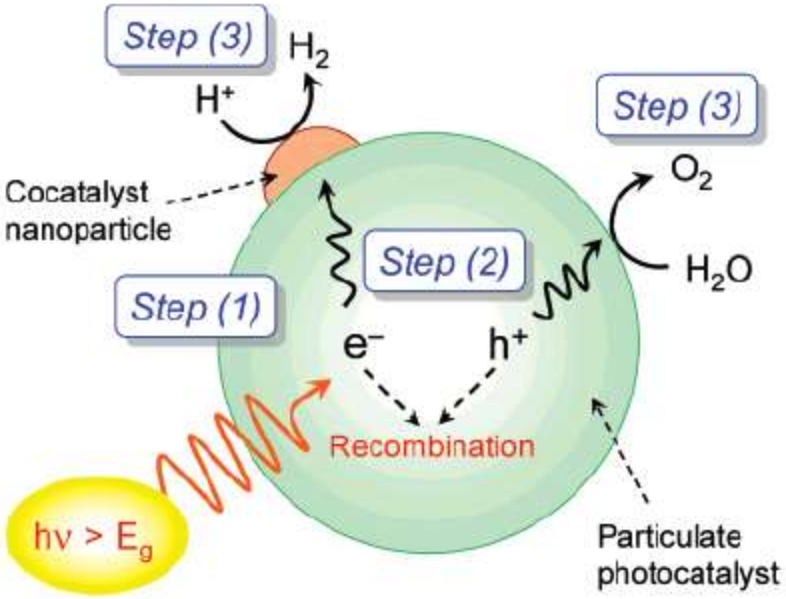
- **Long term stability**: Charge transfer used for water splitting and not corrosion.



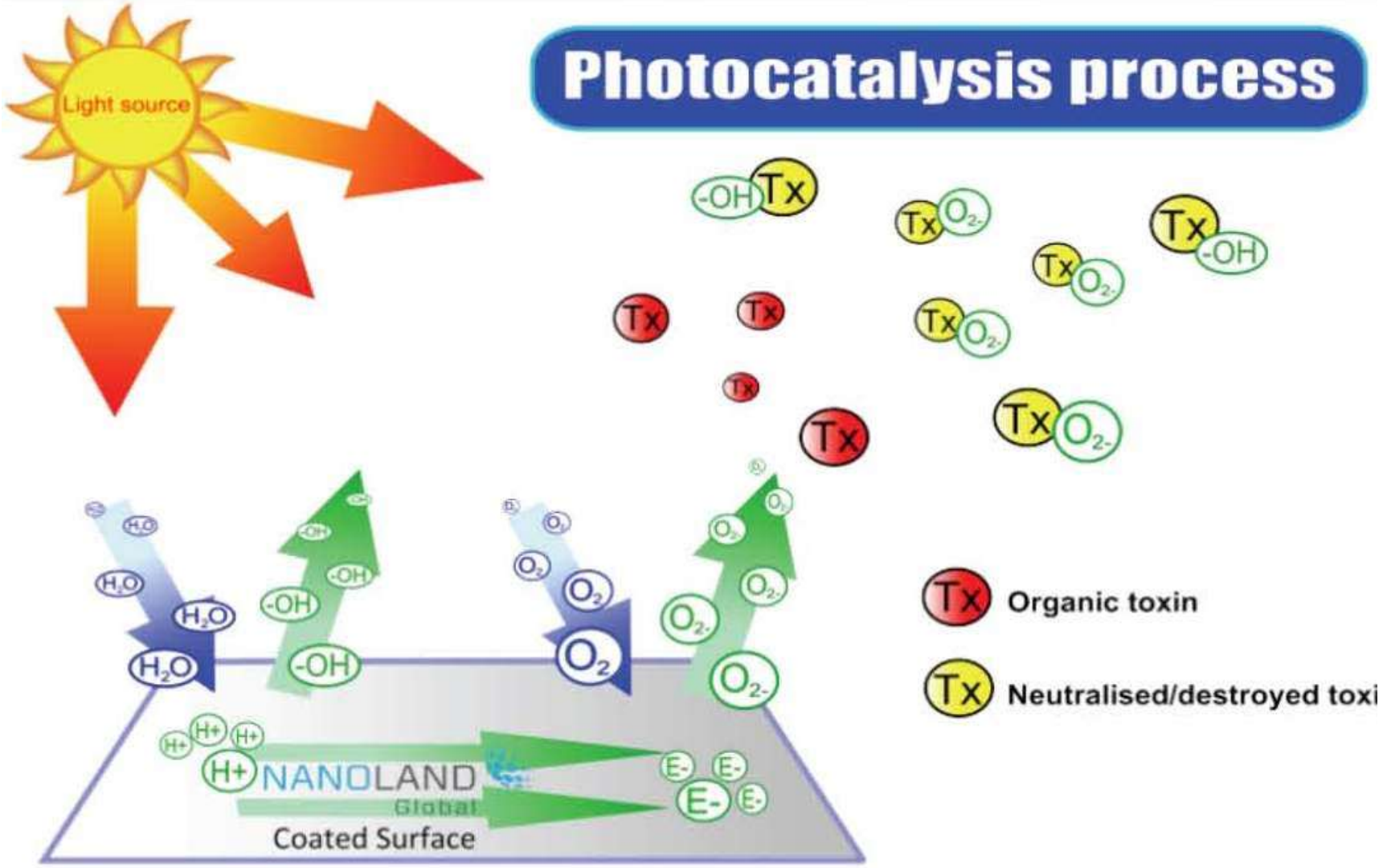
Process

$H_2O \rightarrow 2H_2 + O_2$ $\Delta V = 1.23V$, $\Delta G = 238 kJ/mol$

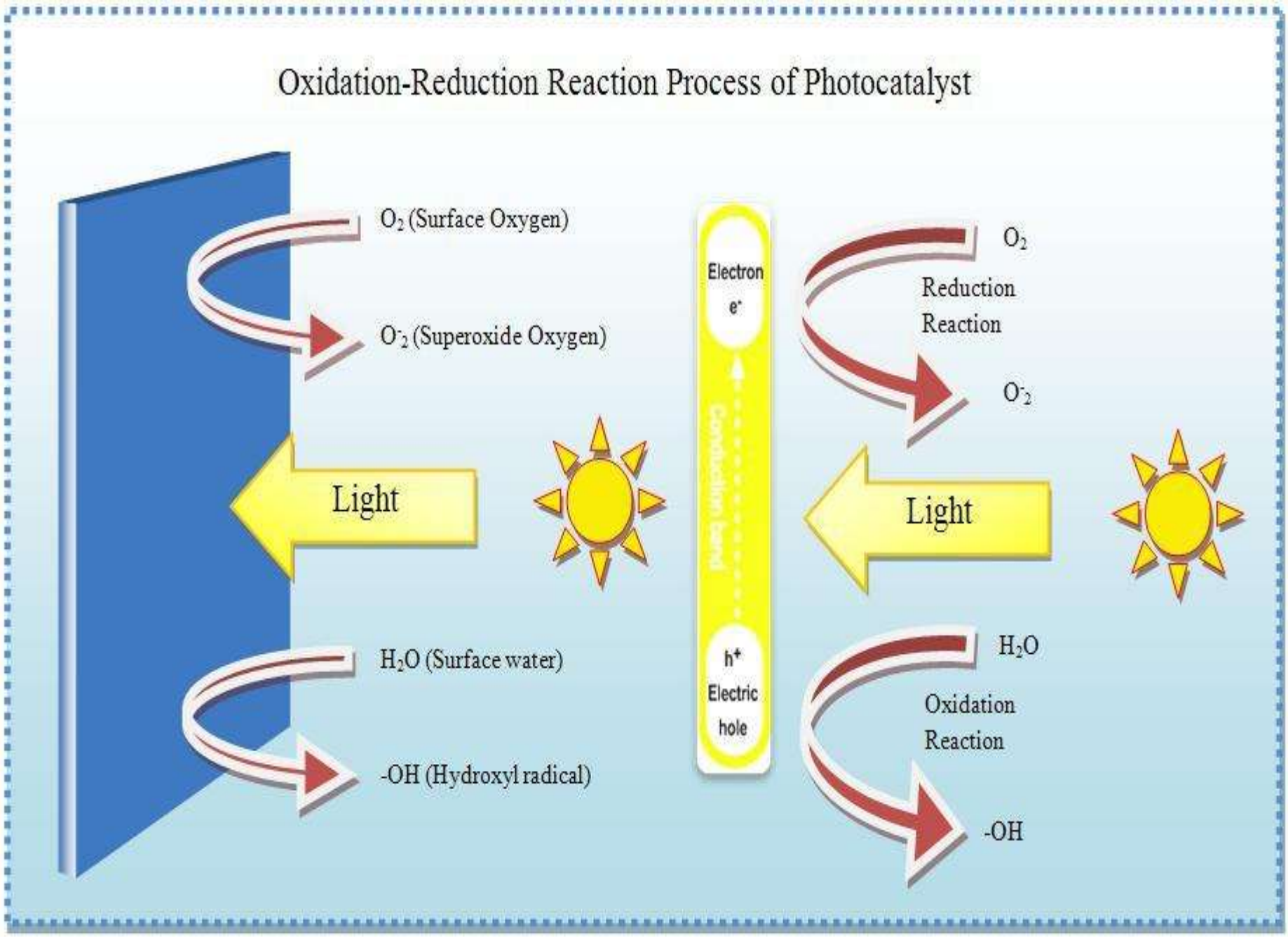
- Step 1: Photon with energy above 1.23eV (λ<~1000 nm) is absorbed.
- Step 2: Photoexcited electrons and holes separate and migrate to surface.
- Step 3: Adsorbed species (water) is reduced and oxidized by the electrons and holes.

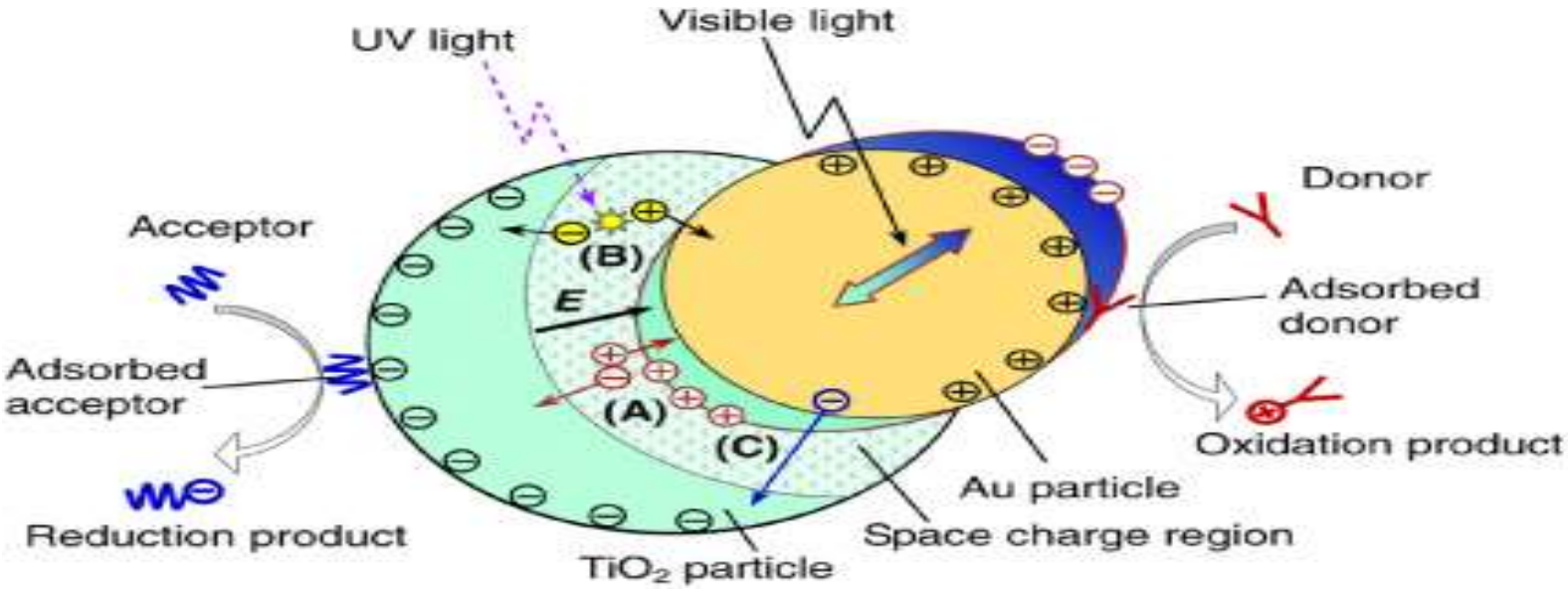


Photocatalysis process

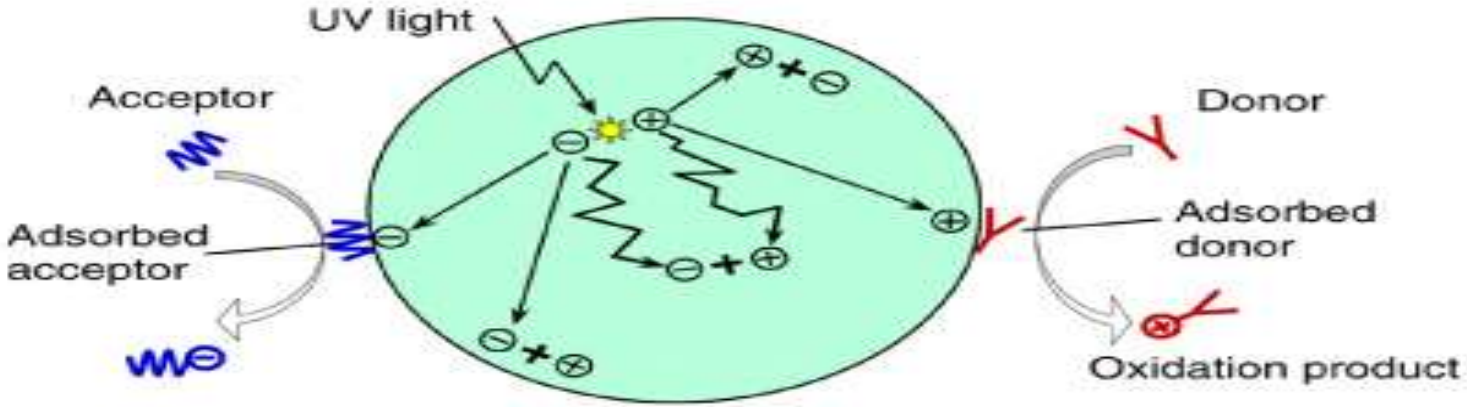


Using the energy from light, the TIO2 molecule creates two oxidation reactants:
Hydroxil radicals and superoxide anions.
These reactants decompose toxic organic substances through oxidation.

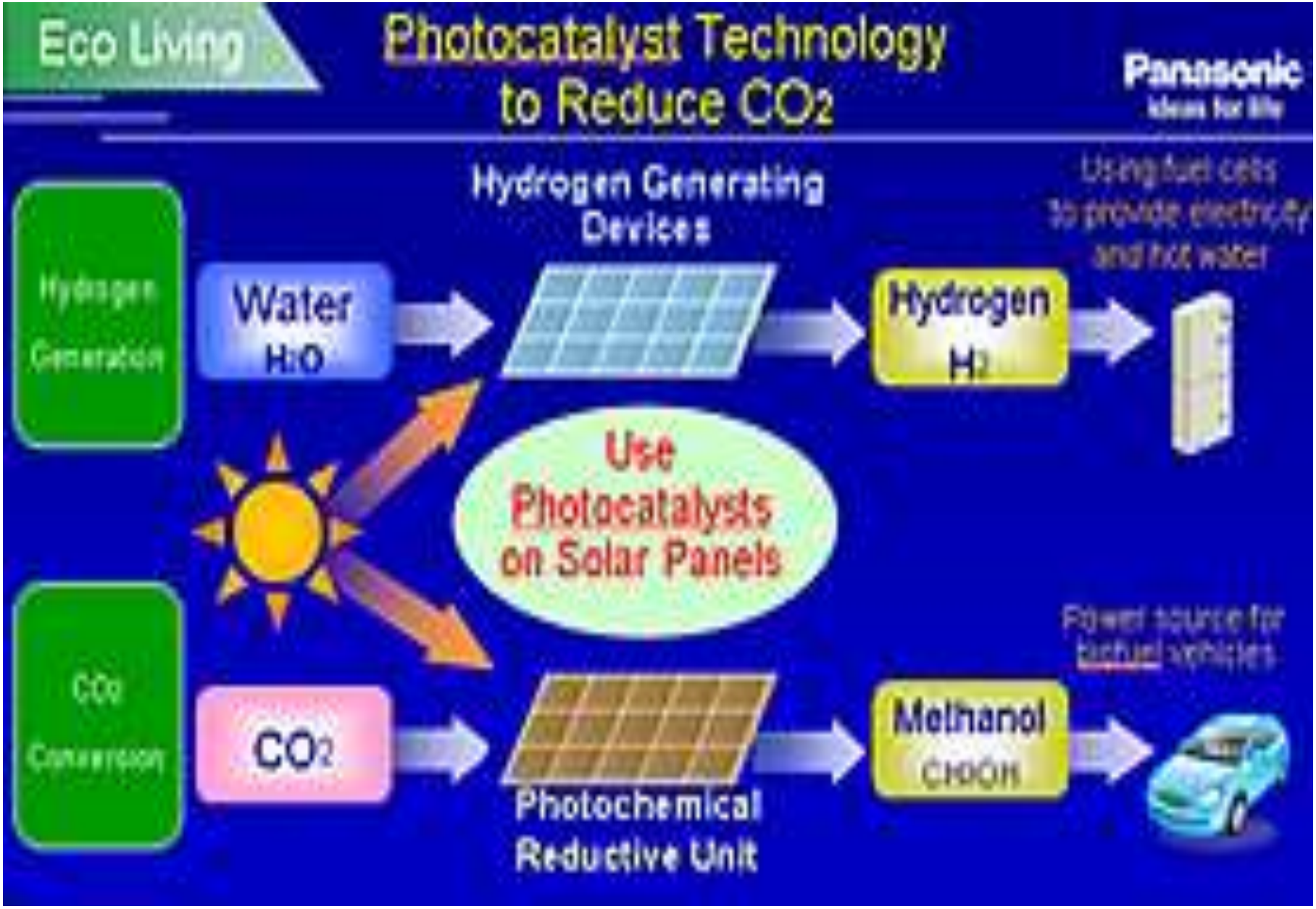

Oxidation-Reduction Reaction Process of Photocatalyst
O2 (Surface Oxygen)
O-2 (Superoxide Oxygen)
Light
H2O (Surface water)
-OH (Hydroxyl radical)
Electron
e-
Conduction band
h+
Electric
hole
O2
Reduction
Reaction
O-2
Light
H2O
Oxidation
Reaction
-OH

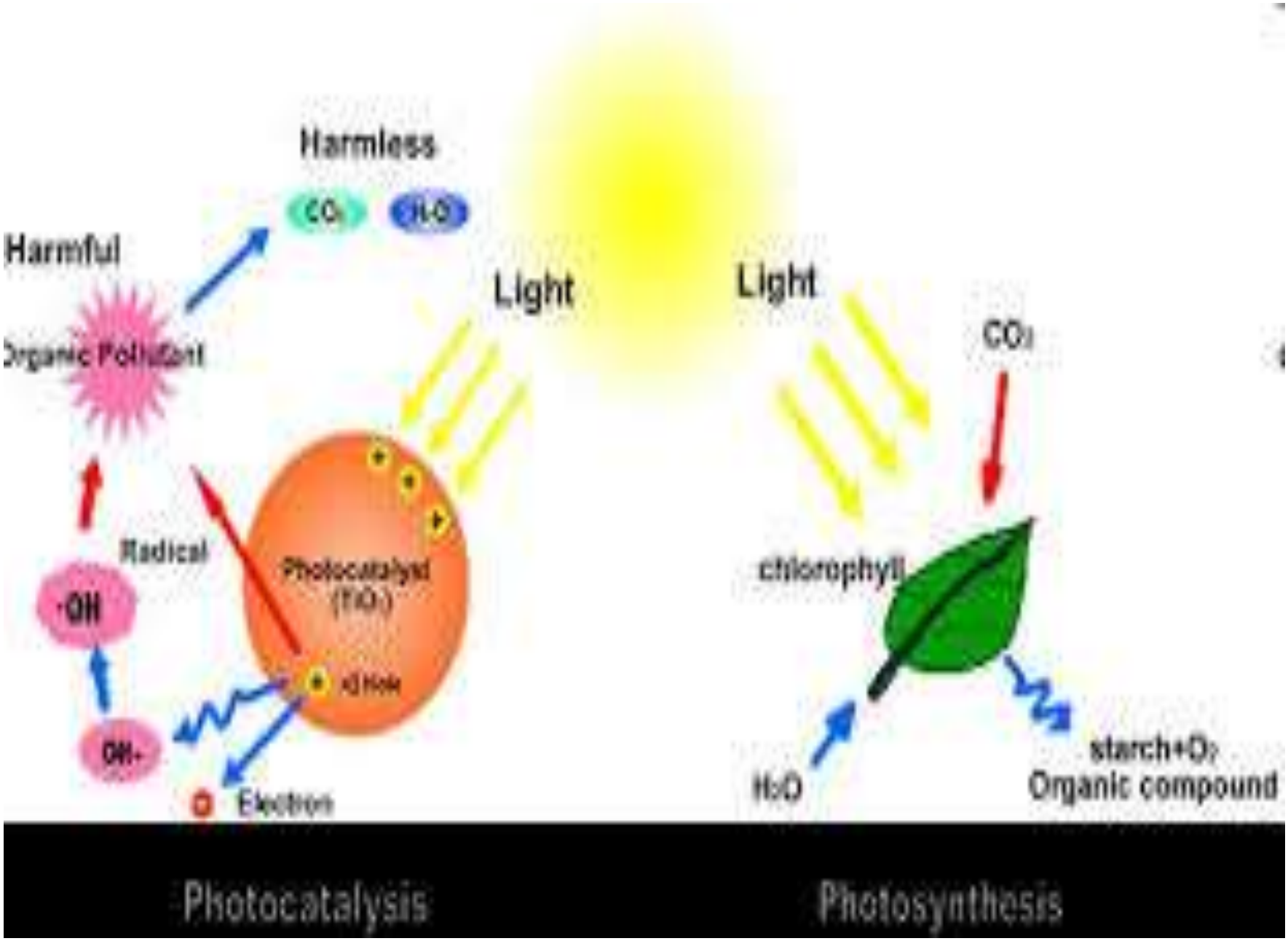


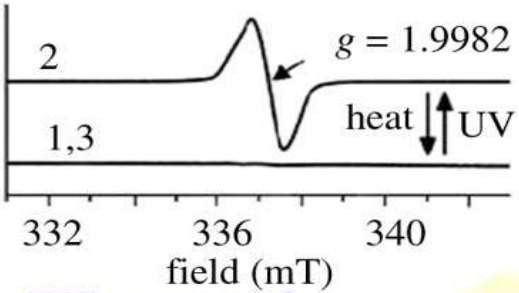
(a) Major processes in plasmonic photocatalysis.



(b) Excessive electron-hole recombination in the common photocatalysis.

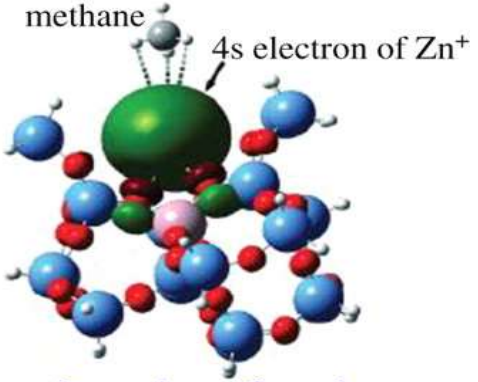

Eco Living
Photocatalyst Technology to Reduce CO_2
Panasonic
ideas for life
Hydrogen Generating Devices
Hydrogen Generation
Water H_2O
Hydrogen H_2
Using fuel cells to provide electricity and hot water
Use Photocatalysts on Solar Panels
CO_2 Conversion
CO_2
Photochemical Reductive Unit
Methanol CH_3OH
Power source for


Harmless
Harmful
Organic Pollutant
Light
Radical
·OH
OH-
Photocatalyst
(TiO2)
Hole
Electron
Photocatalysis
Light
CO2
chlorophyll
H2O
starch+O2
Organic compound
Photosynthesis

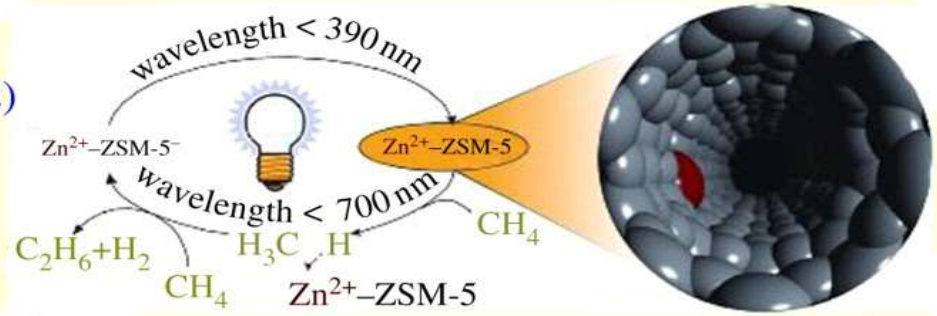


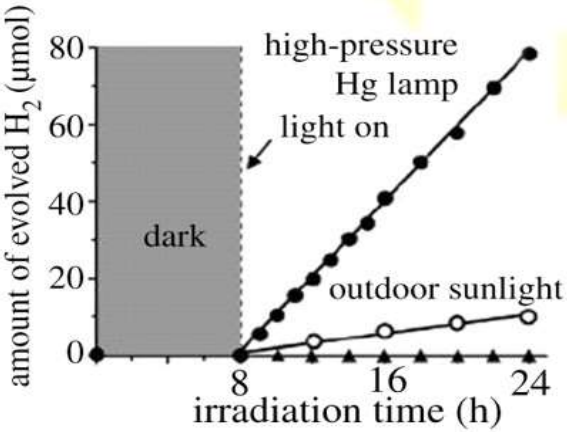
EPR spectra of Zn^{2+}–ZSM-5 (1), (Zn^{+},Zn^{2+})–ZSM-5 (2) and Zn^{2+}–ZSM-5 (3)

$2CH_4 \rightarrow C_2H_6+H_2$

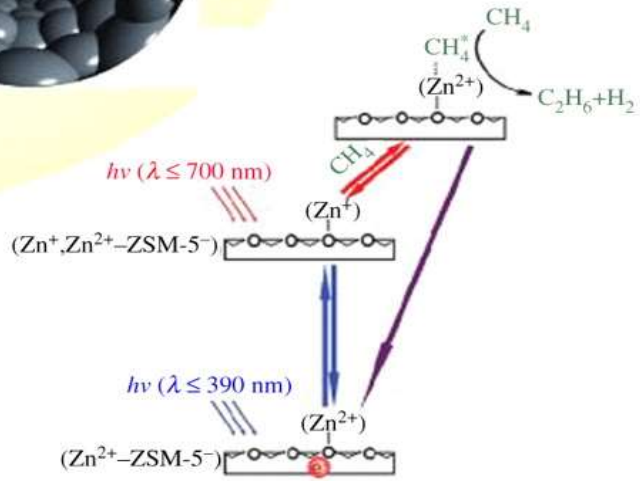


adsorption of methane molecule attracted by the Zn^{+} active site

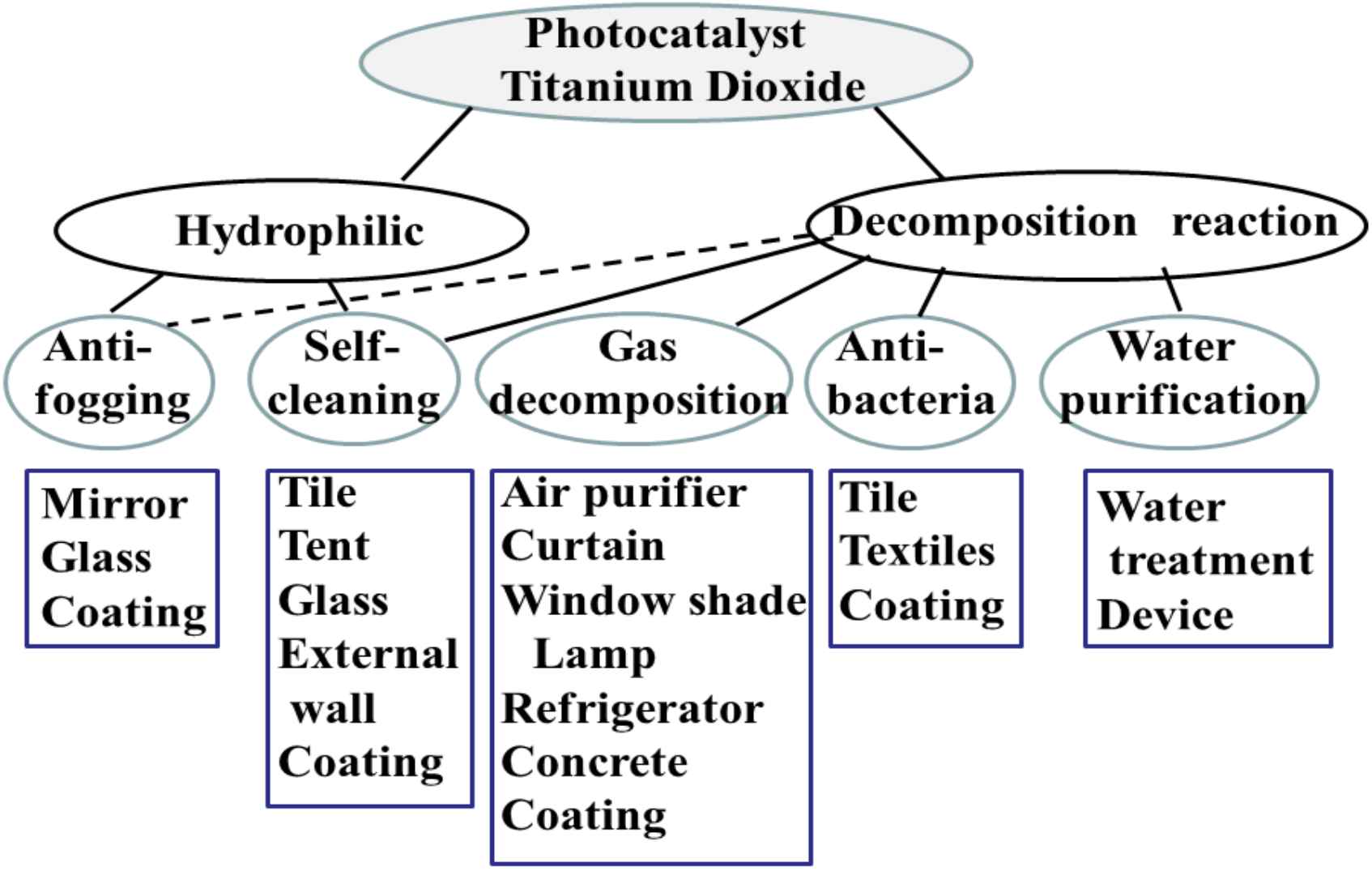




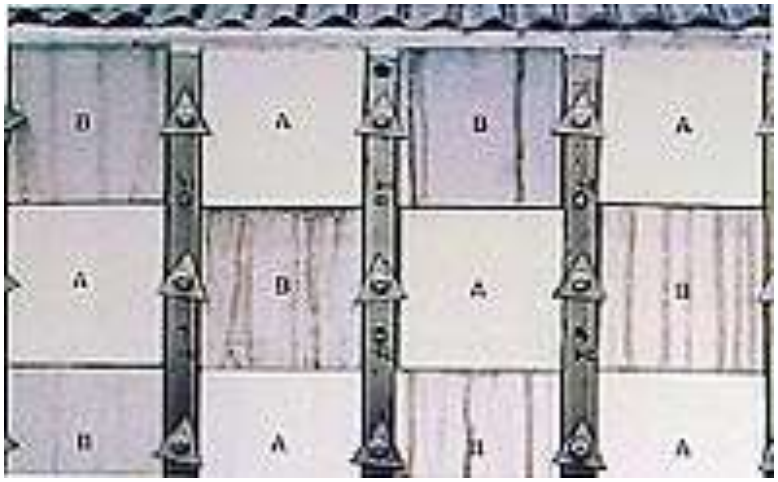
time profile of the conversion of methane to ethane on Zn^{+} –ZSM-5



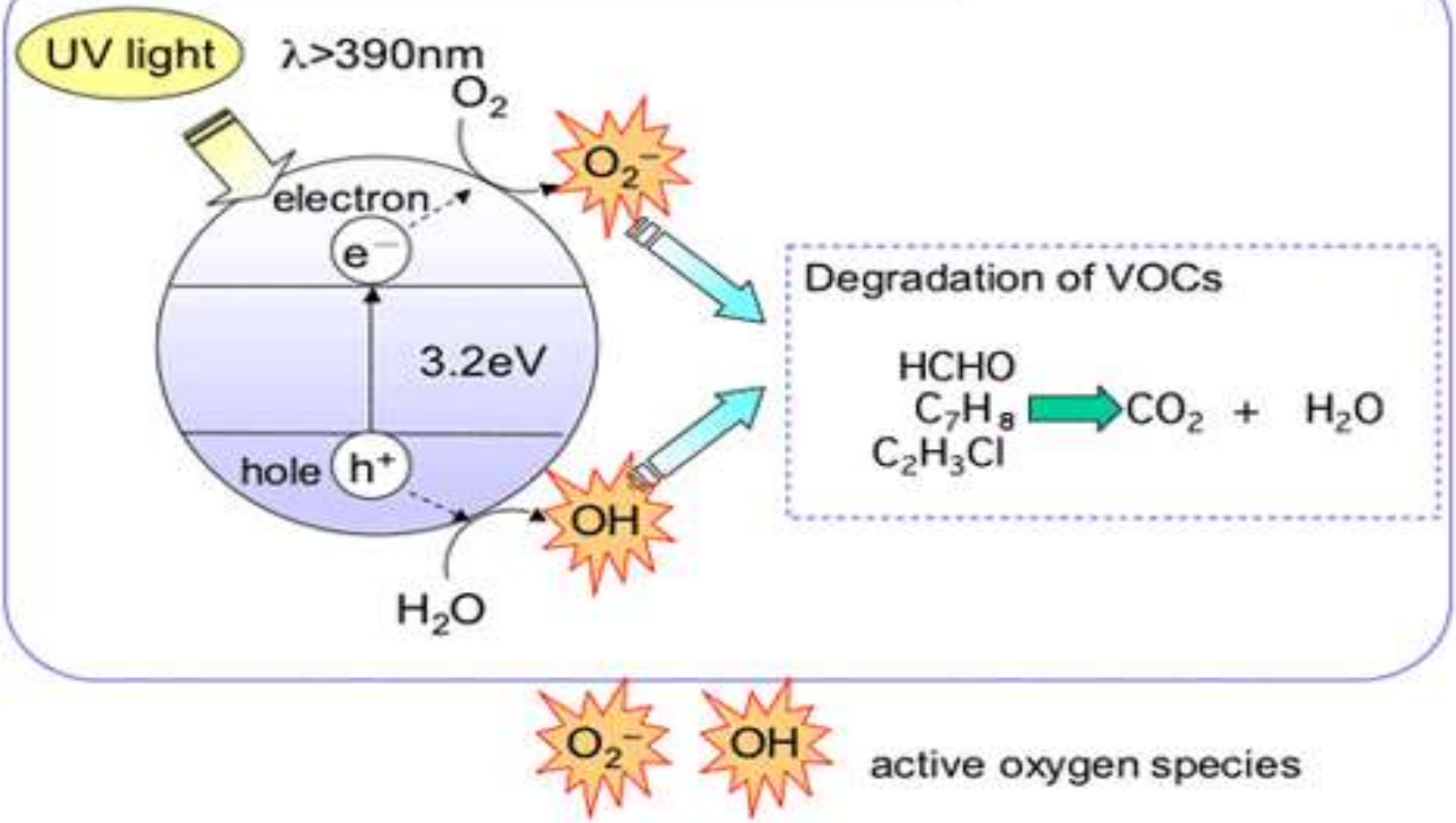
the processes of the photocatalytic reaction


Photocatalyst
Titanium Dioxide
Hydrophilic
Decomposition reaction
Anti-fogging
Self-cleaning
Gas decomposition
Anti-bacteria
Water purification
Mirror
Glass
Coating
Tile
Tent
Glass
External wall
Coating
Air purifier
Curtain
Window shade
Lamp
Refrigerator
Concrete
Coating
Tile
Textiles
Coating
Water treatment
Device

Applications



Air purification by photocatalyst



Journals

1.Analytical & Bioanalytical Techniques
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SIGNATURE

Xincun Dou

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