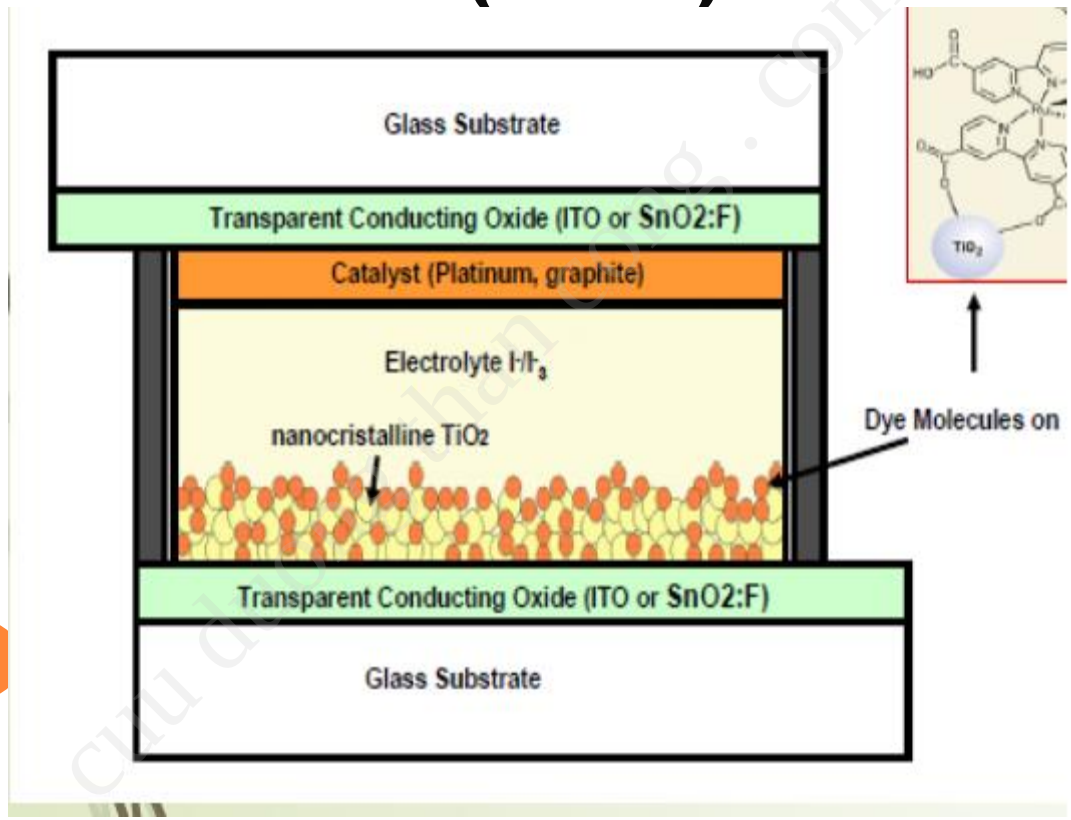
OXIT N N NG TRONG PIN T I T U Y QUANG (DSC)



m 7:

- **n Thi t Kha – 1419135**
- **u Thi Yên – 1419393**
- **Mai m nh - 1419245**

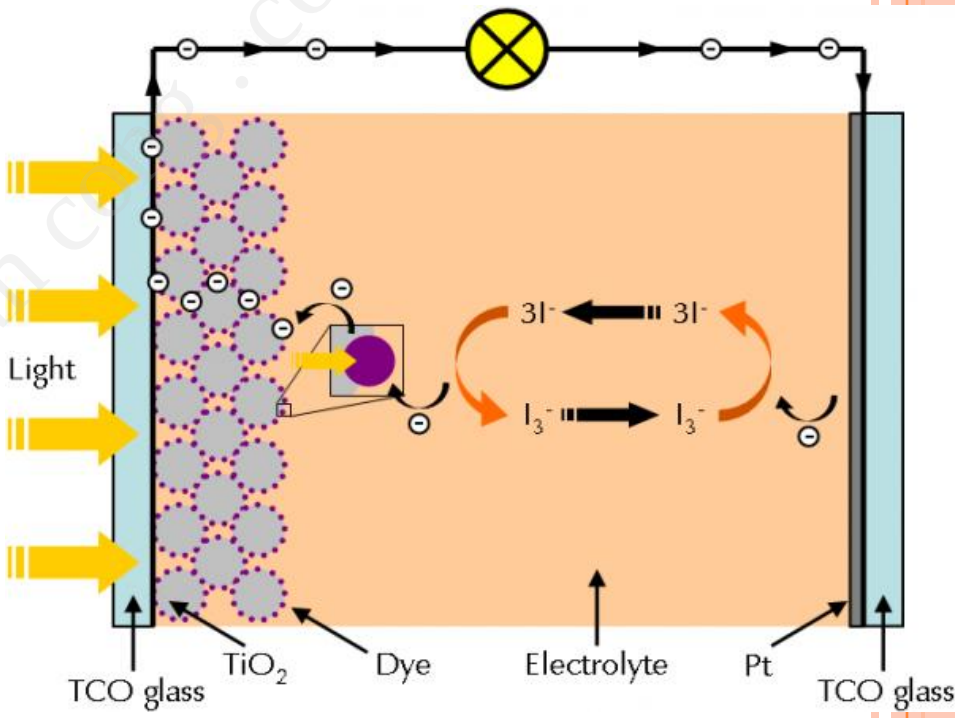
I DUNG

1. • m chung
2. • ZnO
3. • TiO_2
4. • c
5. • n

m chung

c năng:

- t **n** .
- ng
- ch
- => c E_c



ng.

m chung

n:

- y quang.

  t TiO_2 –

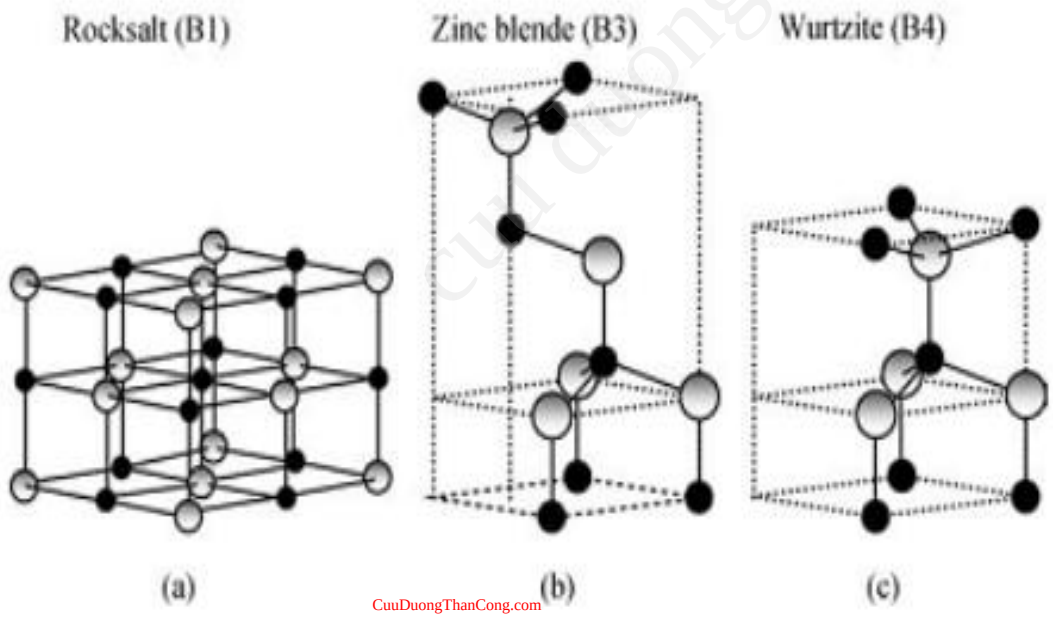
  y quang (-COOH, -H_2PO_3, -SO_3H,..)

- n ly).
- p.
- u.

2. ZnO

Cấu trúc hexagonal wurtzite *là cấu trúc bền, ổn định nhiệt nên là cấu trúc phổ biến nhất.*

ZnO	TiO_2
• ng trong PMT DSC. • Bangap: E_g= 3,4 eV • ng cao hơn TiO_2 • p hơn TiO_2	• ... • Bangap: 3,2 eV (anatase) • p hơn ZnO • c cao hơn ZnO



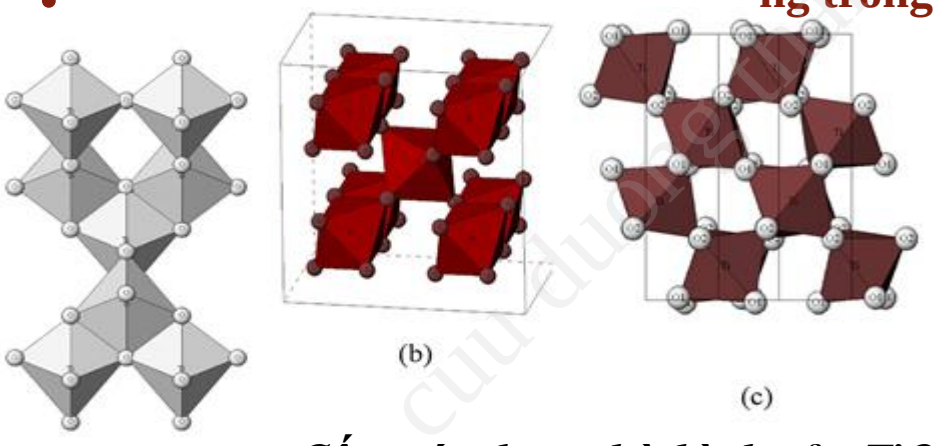
Cấu trúc dạng thù hình của ZnO

- (a) rocksalt
- (b) zinc blende
- (c) hexagonal wurtzite

3.TiO_2

- **m:**
- i
- c
- HF)
- i dd H_2SO_4(đđ, t^o y
- **n**

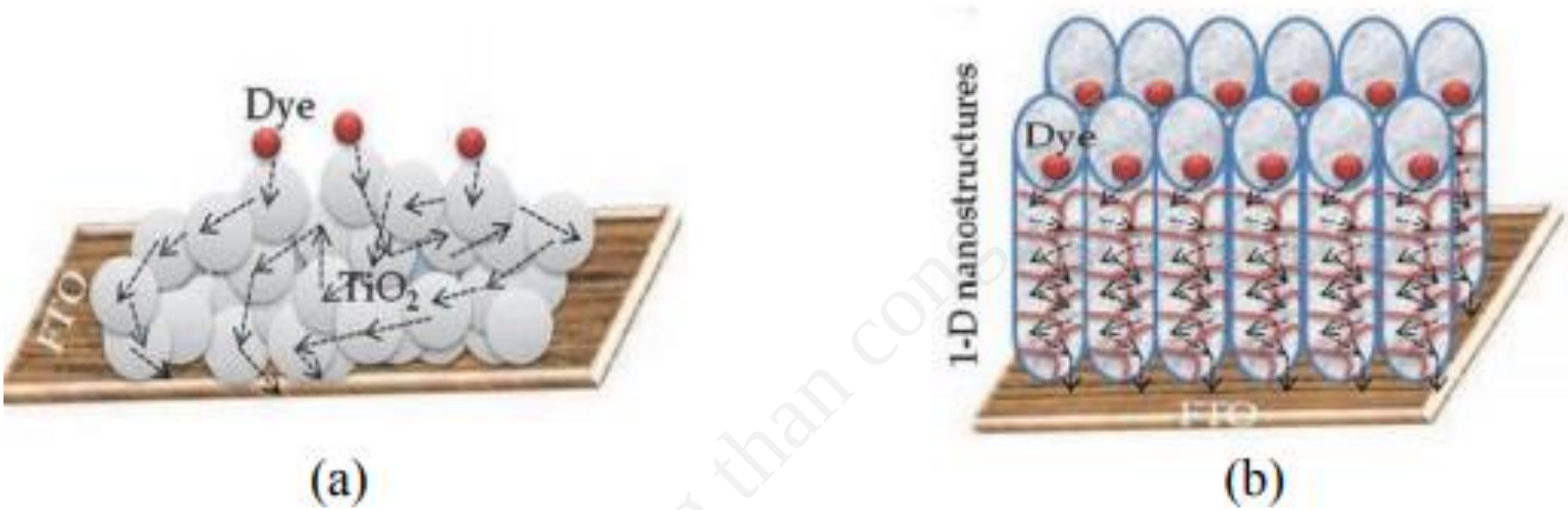
? **ng trong DSC**



Cấu trúc dạng thù hình của TiO_2

- (a) anatase
- (b) rutile
- (c) brookite.

3.TiO_2



Minh họa sự dịch chuyển điện tử trong vật liệu TiO_2 tới điện cực:

(a)TiO_2 ng màng hạt nano

(b)TiO_2 dạng ống (hoặc cột) nano

C

SnO_2

TiO_2

ZnO

- nh
- E_c

y quang:

perylene

- lên

SnO_2 oxit như ZnO, MgO, Al_2O_3, TiO_2

oxit ZnO.

n

t trong pin

DSC.

m cathode,...

- TiO_2 n ly I^-/I_3^- : 5,4%
- TiO_2 n ly I^-/I_3^- : 4,5%
- n ly I^-/I_3^- : 5,6%
- SnO_2 n ly I^-/I_3^- : 2,8%
- SnO_2 n ly I^-/I_3^- : 6,3%

esearch-Cell Efficiencies

NREL
NATIONAL RENEWABLE ENERGY

n Cells (2-terminal, monolithic)
ction (concentrator)
ction (non-concentrator)
ion (concentrator)
ion (non-concentrator)
tion or more (non-concentrator)

ction GaAs
stal
ator
crystal

Si Cells
stal (non-concentrator)
stal (concentrator)
alline
lm
terostructures (HIT)
crystal

Thin-Film Technologies
- Cu(In,Ga)Se_2
- CdTe
- Amorphous Si:H (stabilized)
- Nano-, micro-, poly-Si
- Multijunction polycrystalline

Emerging PV
- Dye-sensitized cells
- Organic cells (various types)
- Organic tandem cells
- Inorganic cells
- Quantum dot cells

Spectrolab (metamorphic, 299x)
Fraunhofer ISE (metamorphic, 454x)
Boeing-Spectrolab (lattice matched, 364x)
Spire Semiconductor (metamorphic, 406x)
Solar Junction (lattice matched, 942x)
Boeing-Spectrolab (metamorphic,179x)
Boeing-Spectrolab (metamorphic, 240x)
NREL (inverted, metamorphic)
NREL (inverted, metamorphic, 325.7x)
Solar Junction (lattice matched, 418x)
NREL
Boeing-Spectrolab
Spectrolab
NREL/ Spectrolab
Spectrolab
NREL (inverted, metamorphic,1-sun)
Sharp (IMM, 1-sun)
FhG-ISE (1-sun)
Japan Energy
NREL
NREL
Varian (205x)
Varian (216x)
SunPower (96x)
Spectrolab (4.0 cm², 1-sun)
IES-UPM (1026x)
FhG-ISE (117x)
Alta Devices
NREL
Radboud Univ.
Amonix (92x)
FhG-ISE (232x)
Alta Devices
Alta Devices
Stanford (140x)
NREL
Kopin
Varian
Spire
Radboud Univ.
FhG-ISE
Alta Devices
UNSW
UNSW
UNSW
UNSW
UNSW
UNSW
NREL Cu(In,Ga)Se_2 (14x)
Sanyo
Sanyo
Sanyo
Sanyo
Panasonic
Stanford
UNSW
UNSW
UNSW
UNSW / Eurosolare
Georgia Tech
Georgia Tech
Georgia Tech
FhG-ISE
ZSW
EMPA (Flex polymer
Sandia National Lab
Westing-house
ARCO
UNSW
Spire
Varian
NREL
NREL
NREL
NREL
NREL
NREL
NREL
ZSW
Fraunhofer ISE
CA
No. Carolina State Univ.
UNSW
University So. Florida
AstroPower (small-area)
NREL
NREL
Univ. Stuttgart
Sharp (large-area)
Univ. Stuttgart
First Solar
LG Electronics
Solarex
NREL (CdTe/CIS)
United Solar (aSi/ncSi/ncSi)
Mitsubishi Chemical
ARCO
Boeing
Kodak
Boeing
Euro-CIS
United Solar
Heliate
Boeing
Kodak
Photon Energy
Boeing
Sharp
NIMS
AMETEK
Monosolar
Kodak
Boeing
ARCO
United Solar
EPFL
EPFL
Kaneka (2 µm on glass)
United Solar
IBM (CZTSSe)
Konarka
Heliatek
Boeing
RCA
Solarex
EPFL
EPFL
NREL / Konarka
Univ. Linz
Solarmer
Konarka
Sumi-tomo
University of Maine
Groningen
UCLA
RCA
RCA
RCA
RCA
Plextronics
Univ. Dresden
Heliatek
University Linz
University Linz
Siemens
NREL (ZnO/PbS-QD)
1980
1985
1990
1995
2000
2005
2010

O

- *Hagfeldt et al , Dye-sensitized solar cells, 2010*
- *Nguyễn Văn Tuyên,“ Nghiên cứu chế tạo vật liệu nano ZnO, TiO2 dùng cho pin mặt trời sử dụng chất nhạy màu”, Luận văn Thạc sỹ Vật lý chất rắn, 2012*

c, ĐH.KHTN Tp.HCM)