10th US-Korea Forum on Nanotechnology

Nano-fabrication Processes for Energy Conversion Materials in KIMS

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KIMS 재료연구소 Korea Institute of Materials Science

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I. General Introduction

History of KIMS

Korea Institute of Materials Science (KIMS) established

Materials Science Institute

KIMM Changwon Branch

'07.4

'02.3

'93.4

'92.3

'81.1

'76.12

KIMM Headquarter moved to **Daejeon**

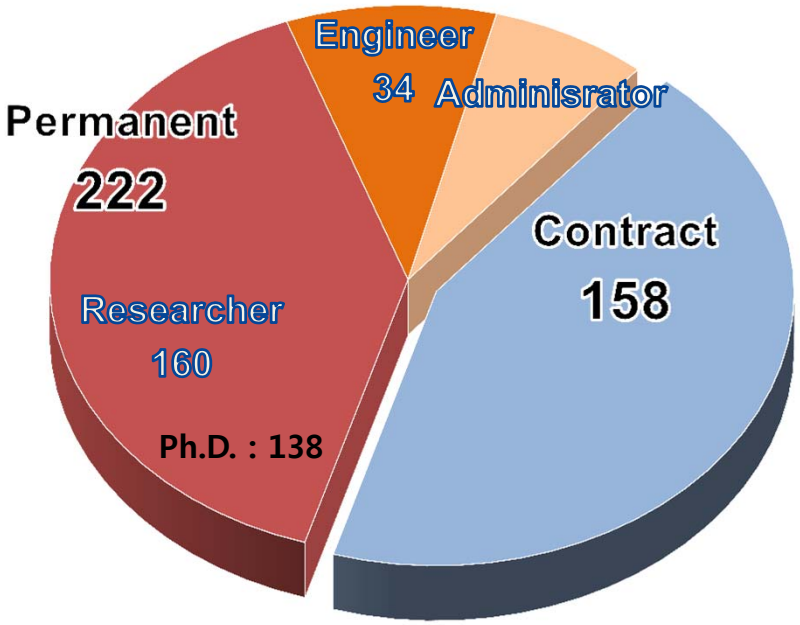
Korea Institute of Machinery and Materials (KIMM) launched (in **Changwon**)

Korea Test Institute of Machinery and Metals established.

Personnel & Budget

KIMS

380(2012)



$66million (2012)

Income	Outcome
Government Grant (41%)	Personnel Expenses (24%)
Others (59%)	Direct Research Fee (62%)
	Operating, etc. (14%)

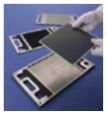
Role & Function

KIMS

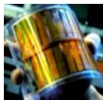
Promotion of the innovative materials technology through R&D, Test & Evaluation, Technology support

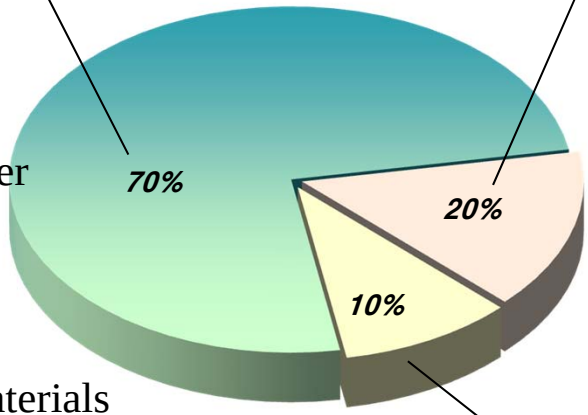
R&D : Materials Development & Processing Technology


Metals


Ceramics & Powder

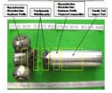

Hybrid materials


Surface related materials



Test & Evaluation


Materials Characterization


Failure Analysis


Authorized Nuclear Inspection


Calibration/Standardization

Technical Support

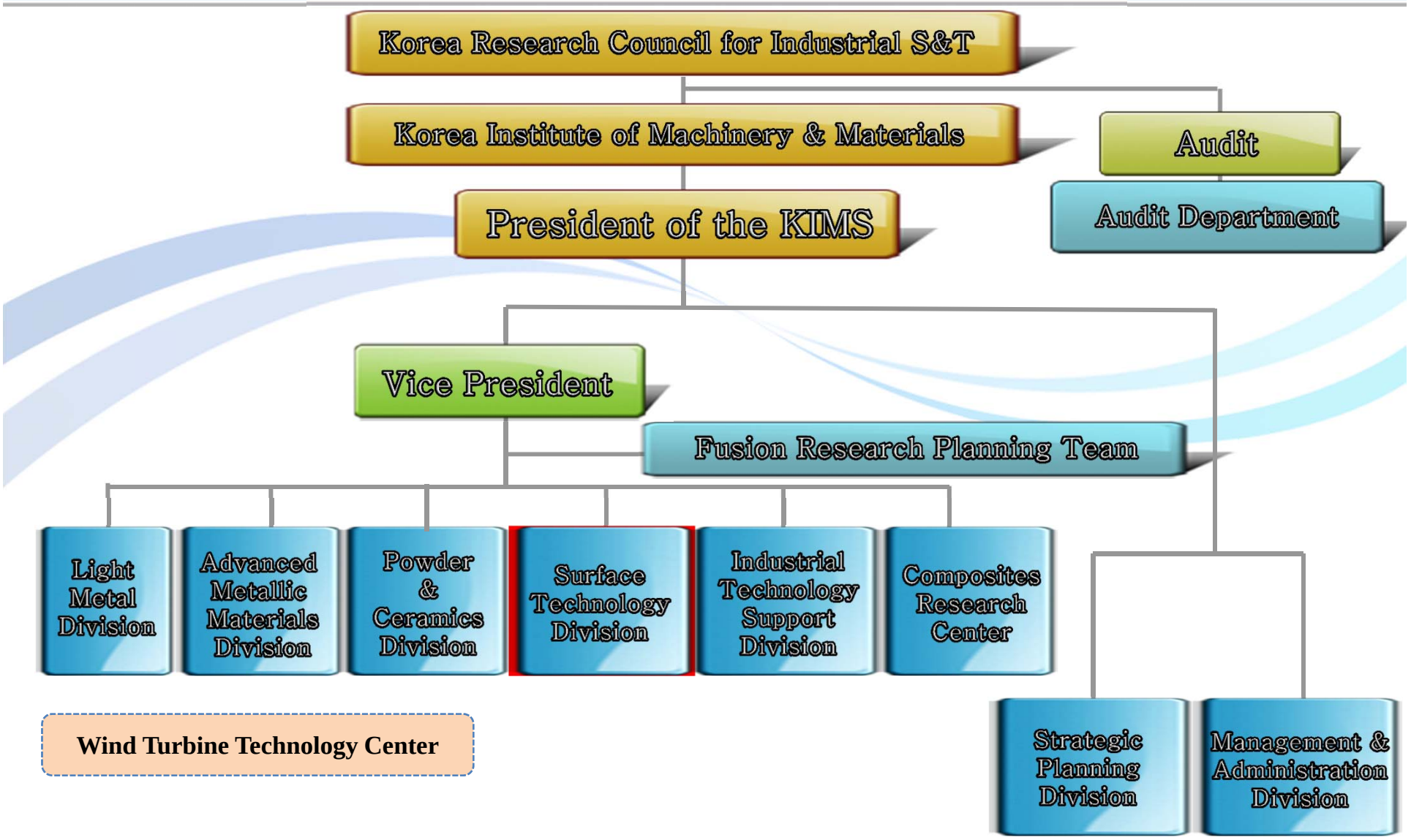
Metals Bank


Materials Test-Bed


Bottleneck Technology Support


Technical Training for Engineers

Organization of KIMS



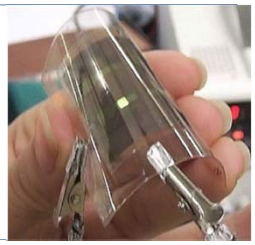
R&D Activities of Surface Technology Division

Surface Technology

Electrochemistry

Joo Yul Lee
leeact@kims.re.kr

- **Solution-based coating technology for energy conversion materials**



Plasma Coating Technology

Do-Geun Kim
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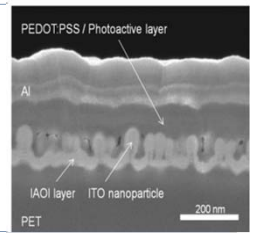
- **Development of plasma sources for roll-to-roll processes**
- High density plasma processes for surface treatment

Advanced Functional Thin Films

Dong-Ho Kim
dhkim2@kims.re.kr

- **Materials and device fabrications of thin film solar cells (Si thin films, OSC, Hybrid)**
- Nano-architectured materials of sensors

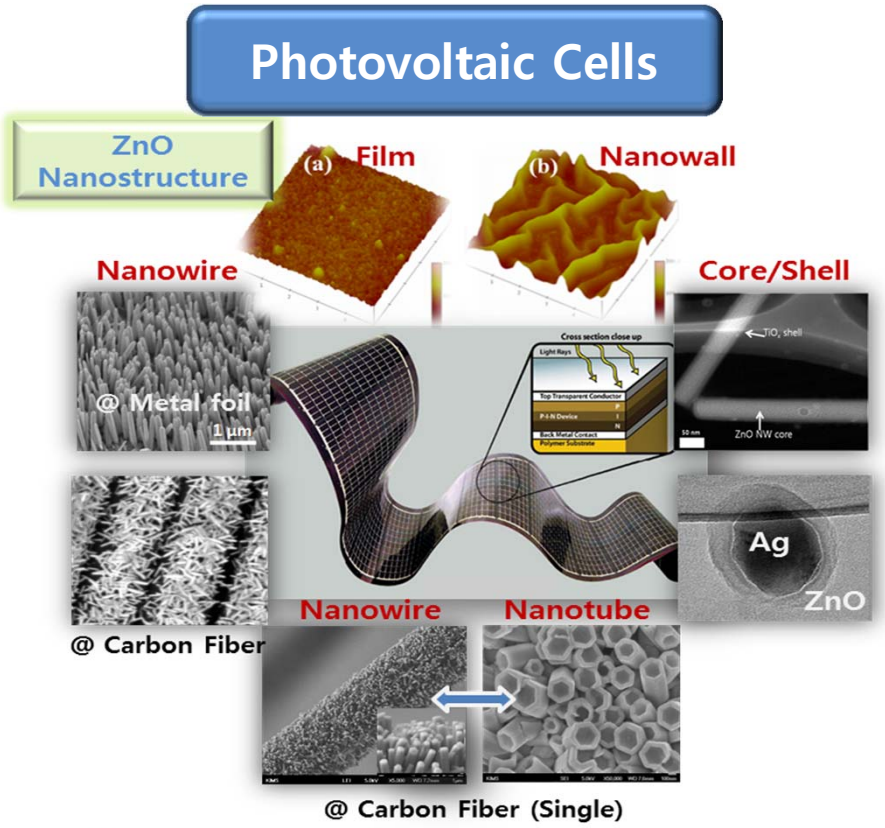


II. Nano-fabrication processes for energy conversion materials in KIMS

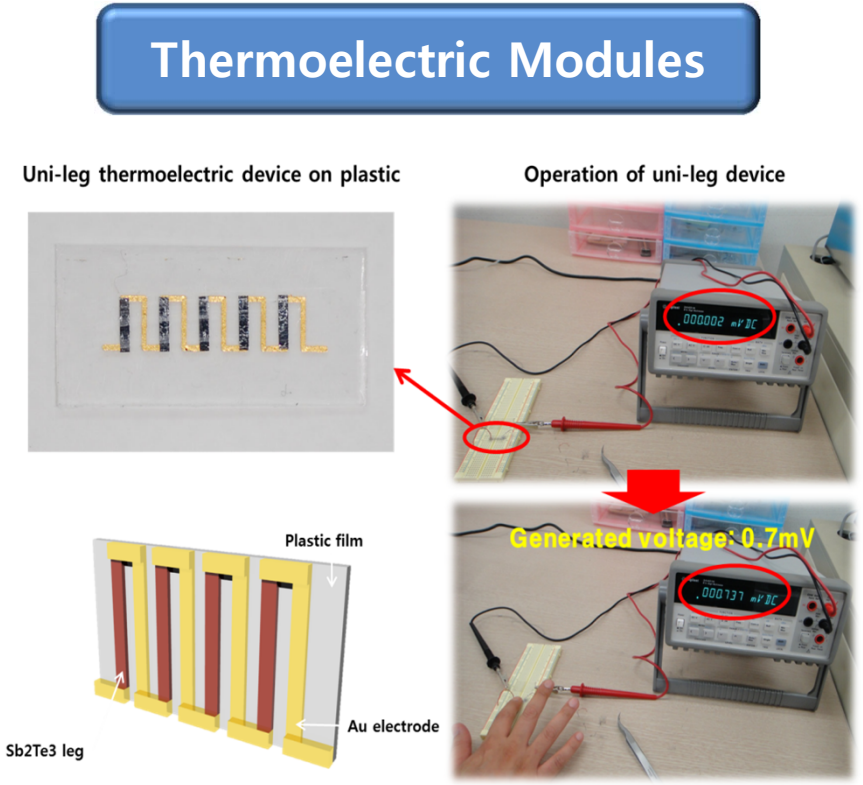
Solution processes for energy devices

KIMS

- **Development of core materials for hybrid energy harvesting using solution process**
- Formation of various nanostructures of ZnO by electroplating
- Fabrication of flexible thermoelectric (TE) modules



Control of ZnO nanostructures



Fabrication of TE modules

Dong Chan Lim
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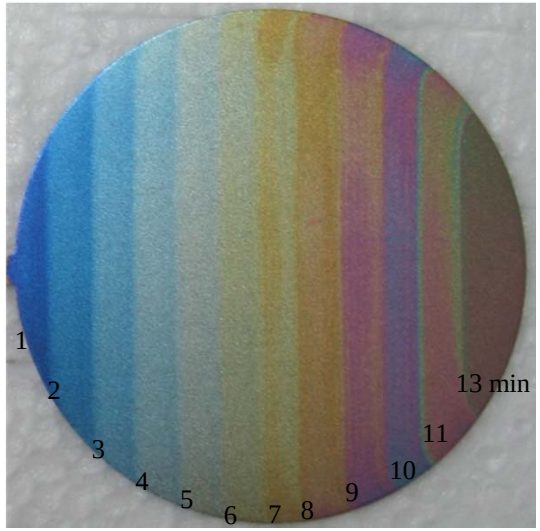
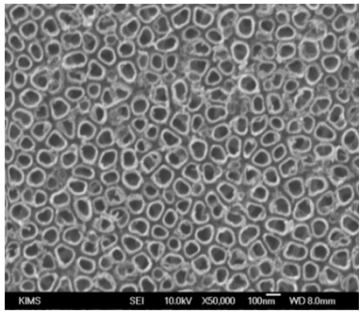
Anodizing Technologies

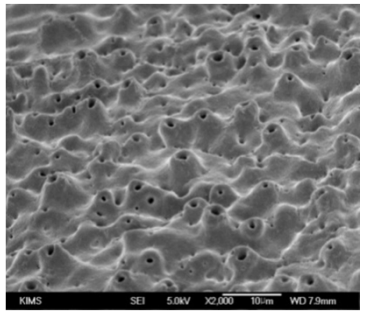
- **Nano-porous and corrosion resistive anodic coatings on Al, Ti and Mg alloys**
  - **Anodizing method / Plasma electrolytic oxidation method (PEO)**
- Hard and soft anodic oxide films on Al alloys
- TiO_2 nanotubes and anodic oxide films for bio-applications



Change in color of Ti

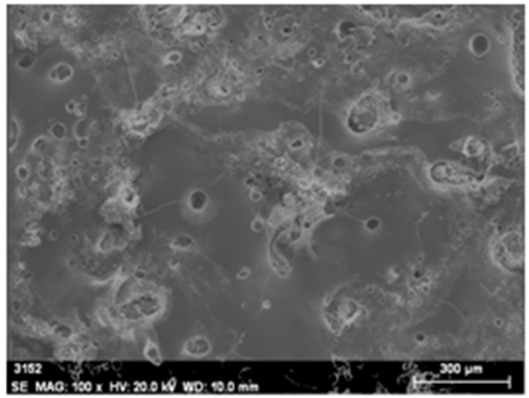


Formation of TiO_2 nanotubes



Increased bioactivity of PEO treated Ti

PEO of Ti for dental implant



PEO films on Mg alloys

Kyu Hwan Lee
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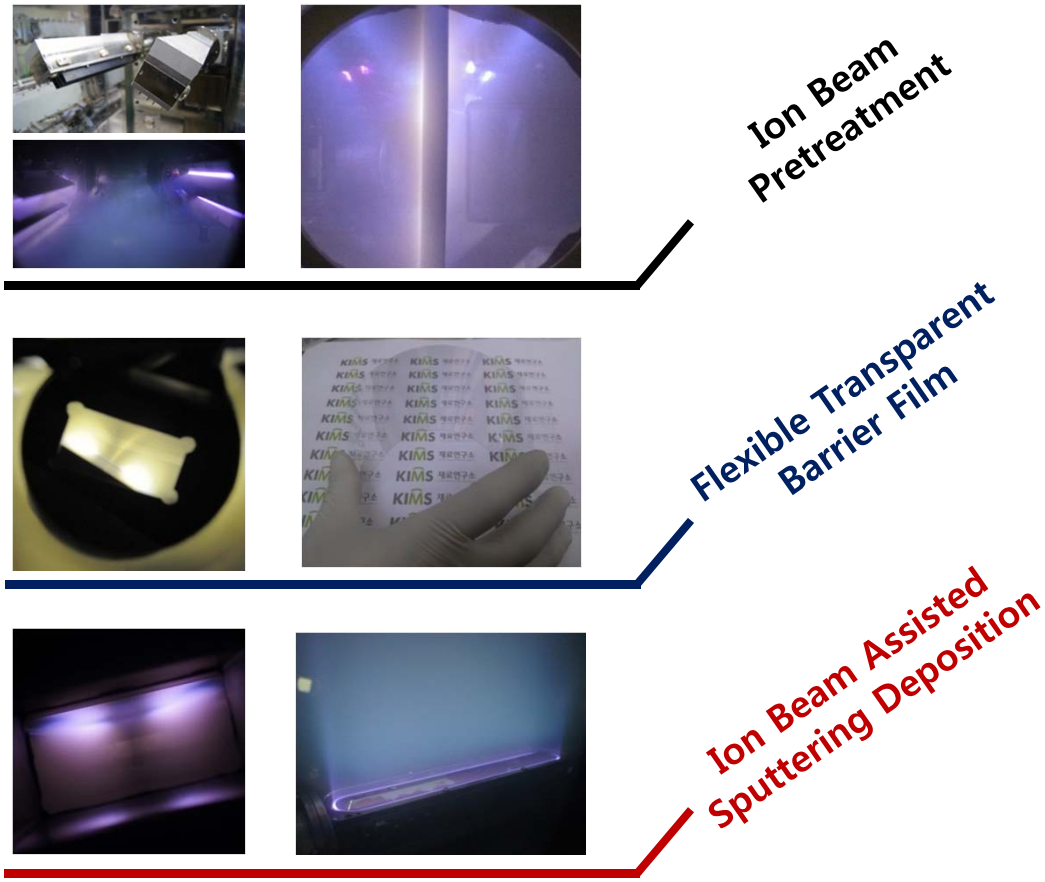
Linear Ion Source & Process

KIMS

- Development of linear plasma (Ion) sources for R2R process
- Investigation of functional thin film coating process



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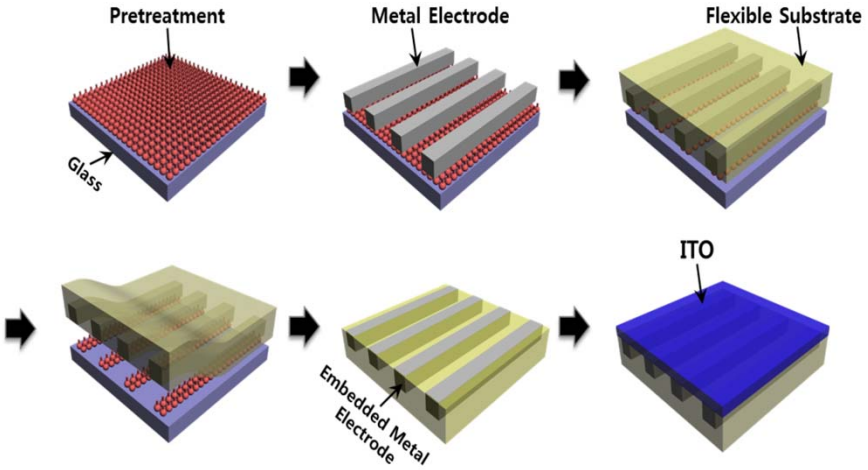
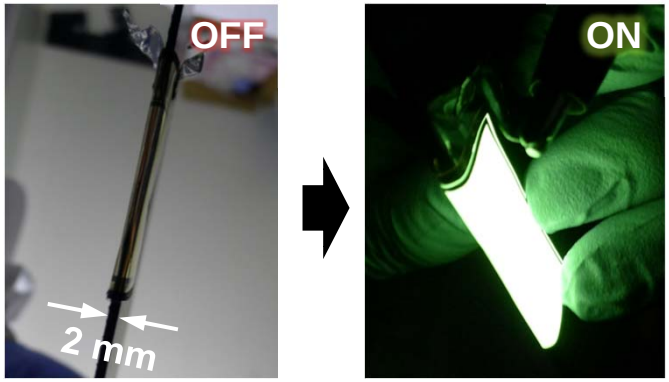
Metal Embedded TCE (Transparent Conducting Electrode) KIMS

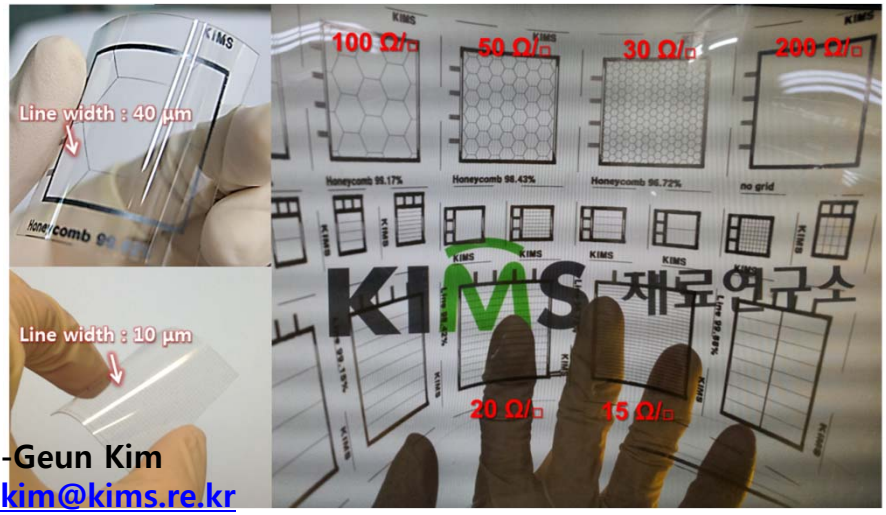
- Surface technology is very important to the flexible electronics and photovotaics
- Development of highly transparent, conductive, and flexible substrates

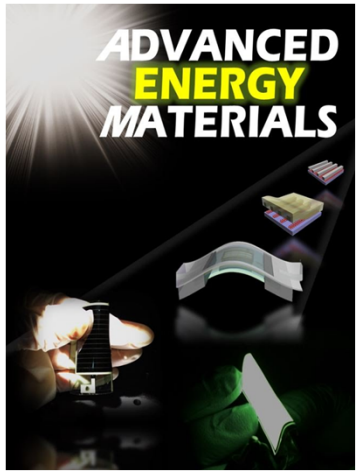




Ultra-Flexible OLED

Substrate size : 50x50 mm²





(Cover Article on Advanced Energy Materials)

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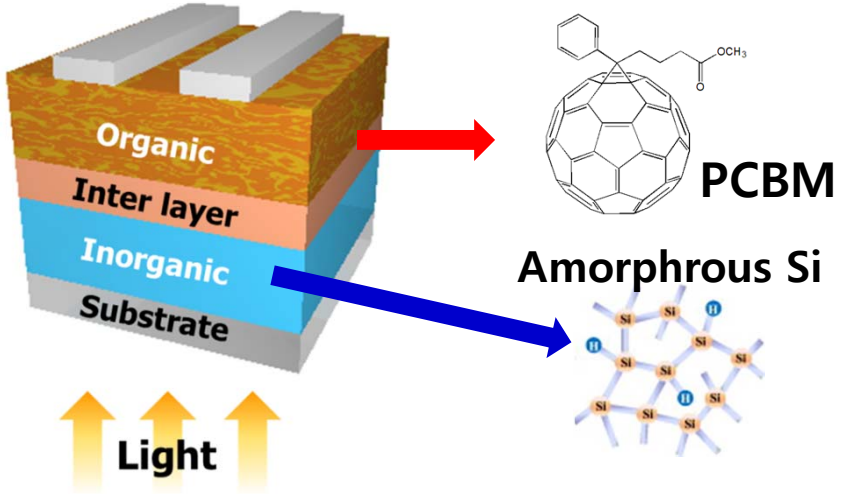
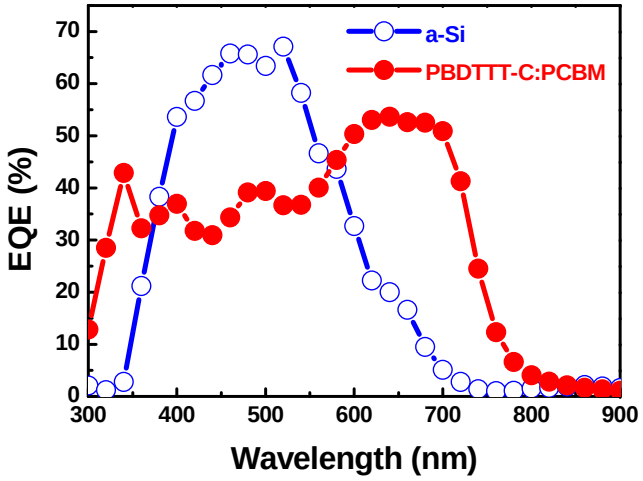
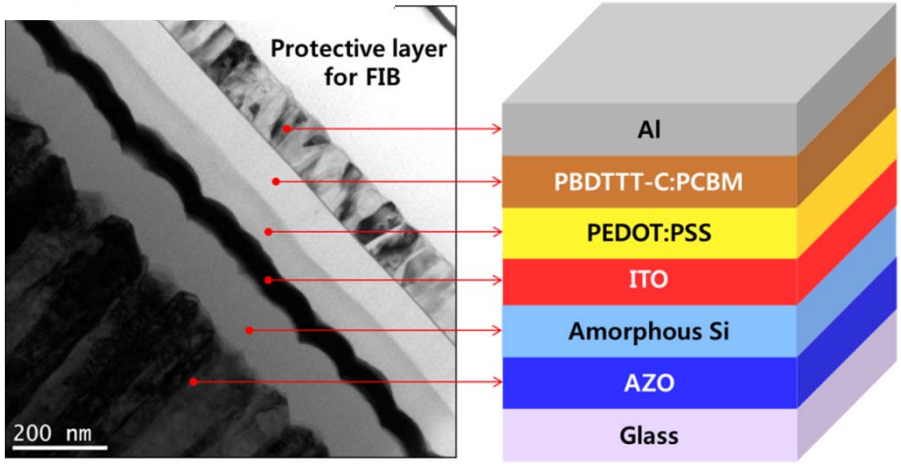
Hybrid tandem solar cells

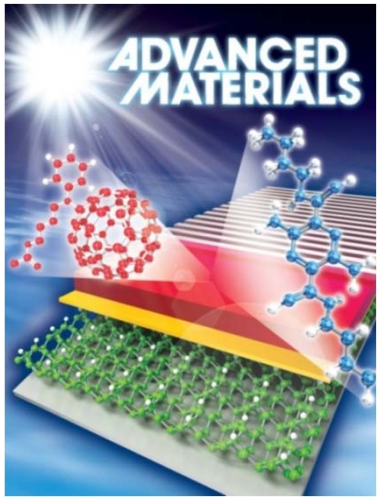
KIMS

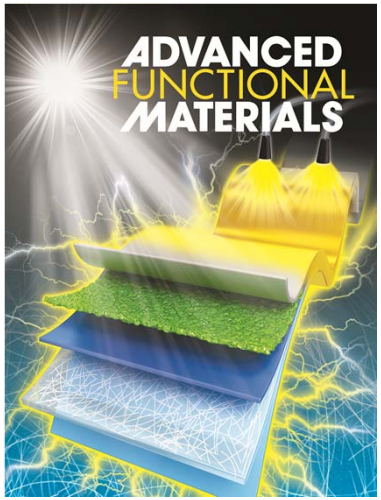
- Development of organic/inorganic hybrid tandem solar cells
- Low cost, simple process & large-area coating











(Featured as Cover Articles)

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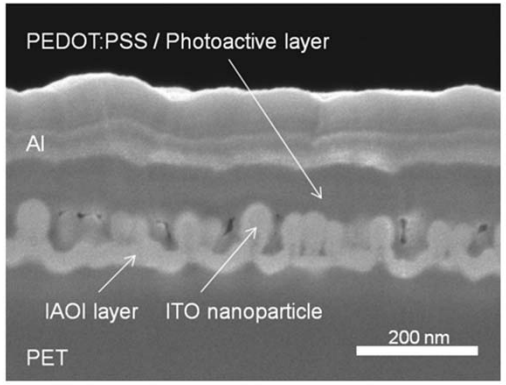
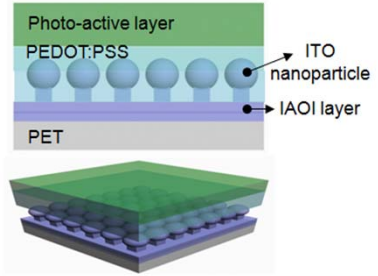
3D Nano-architecturing Process

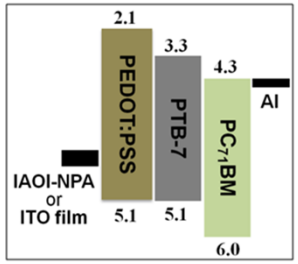
KIMS

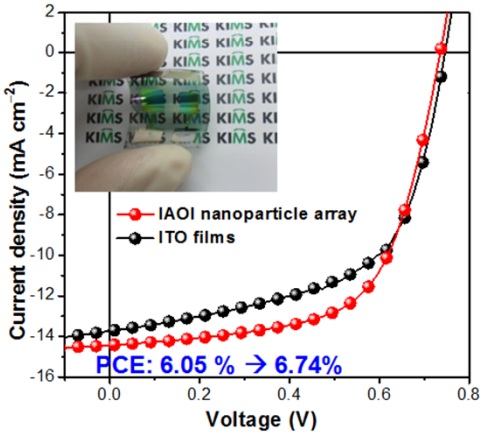
- **3D transparent conducting electrode for flexible organic solar cells (OSC)**
  : Record high power conversion efficiency of 6.74% for bendable OSC based on polymer substrates



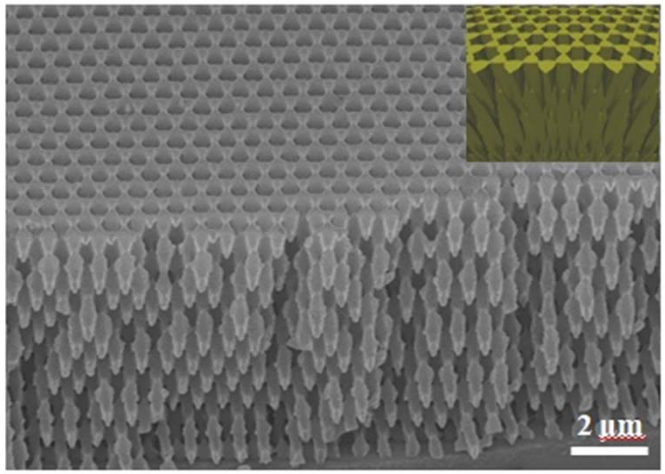


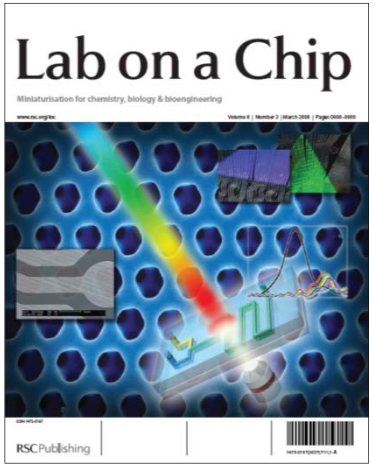
3 min pretreatment

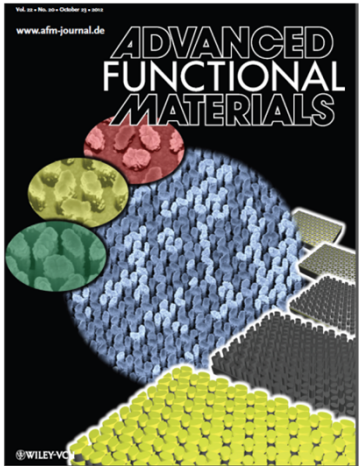




- **3D Photonic nanostructures : Laser Interference Lithography**







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Vision of Nano-surface Technologies

KIMS

❖ **Bring Happiness to Human Beings through Nano-surface Technologies**

Global Materials Technologies in 2020

- Flexible and Stretchable Materials for Future Electronics
- Nano Materials for Next Generation Energy Sources
- Sensing Materials for Human Care with Nano-architecturing

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