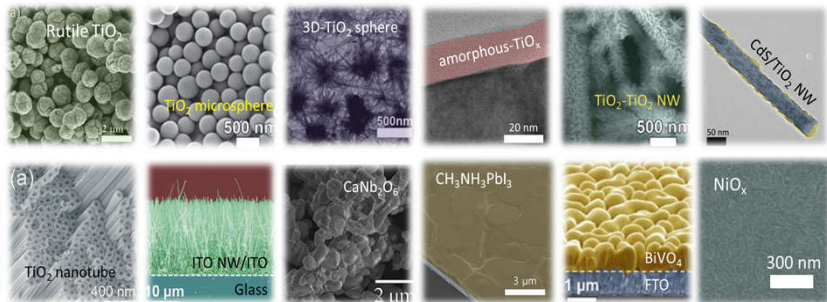




Professor. 김동회 (Kim, Dong Hoe)

- * 2019.03 ~ present : 세종대학교 조교수
- * 2018.02 ~ 2019.02 : Scientist III, National Renewable Energy Laboratory (USA)
- * 2015.04 ~ 2018.02 : Postdoctoral Researcher, National Renewable Energy Laboratory (USA)

◆ 소재 합성 및 물성 연구



✓ 소재 합성

- 무기 반도체 TiO_2 , NiO_x , $BiVO_4$, $CaNb_2O_7$, CdS etc.
- 무기 도체 ITO etc.
- 유무기 복합 반도체: $CH_3NH_3PbI_3$

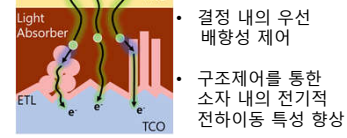
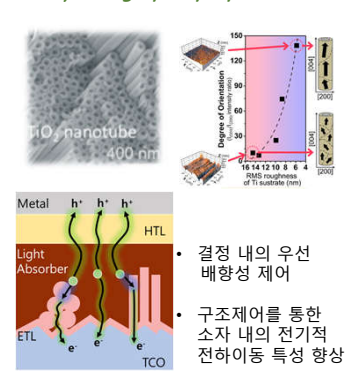
✓ 구조 제어

- Nanosphere (0D)
- Nanorod (1D)
- Thin film (2D)
- Multi-dimension

✓ 공정 제어

- 고상: Solid-state, Anodizing
- 액상: Hydrothermal, Precipitation, Chemical Bath Deposition, Sol-gel coating
- 기상: Evaporator, ALD, Laser-ablation, Vapor-Liquid-Solid

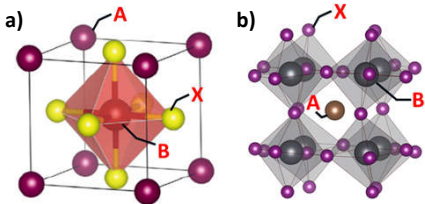
✓ Crystallographic properties



- 결정 내의 우선 배향성 제어
- 구조제어를 통한 소자 내의 전기적 전하이동 특성 향상

◆ 유무기 복합 소재 합성 및 응용

□ Organic-Inorganic Perovskite (PVSK)



Typical crystal structure of perovskite with different viewpoints.

a) Materials Scientist, b) Chemist

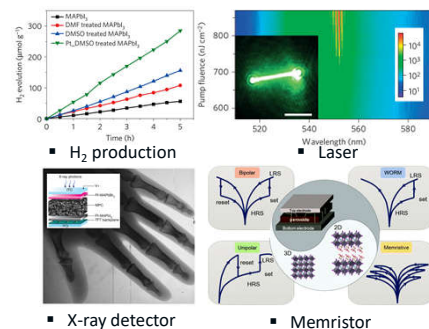
✓ Composition and Structure of PVSK (ABX_3)

- A = $CH_3NH_3^+$, $HC(NH_2)_2^+$, Cs^+ , Rb^+ and etc.
- B = Pb^{2+} , Sn^{2+} and etc.
- X = I^- , Cl^- , Br^- and etc.

✓ Material properties of PVSK

- Outstanding absorption coefficient ($> 10^4 \text{ cm}^{-1}$)
- Long carrier diffusion length ($> 1 \mu\text{m}$)
- High defect tolerance
- Composition & bandgap tunability (1.2~2.3 eV)

□ PVSK on Other Research Area



▪ H₂ production

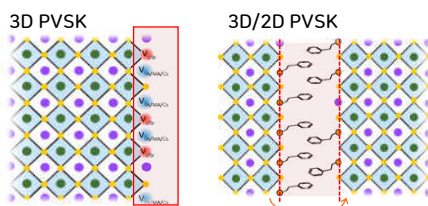
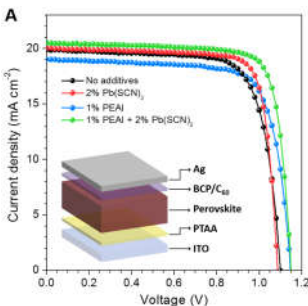
▪ X-ray detector

▪ Laser

▪ Memristor

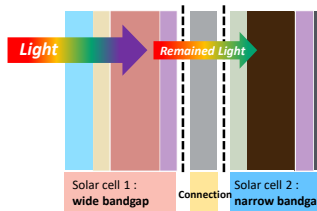
◆ 페로브스카이트 소재 기반 태양전지

□ Perovskite Solar Cells

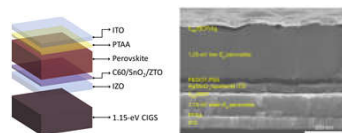


- P-type-Insulator-N-type (P-I-N) 구조의 태양전지 소자 제작
- 2D/3D 다차원 페로브스카이트 개발을 통한 고효율 태양전지 소자 구현

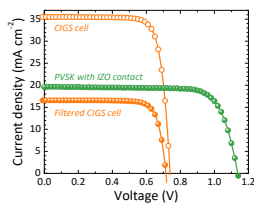
□ Multi-junction (Tandem) Solar Cells



▪ Tandem solar cell 원리

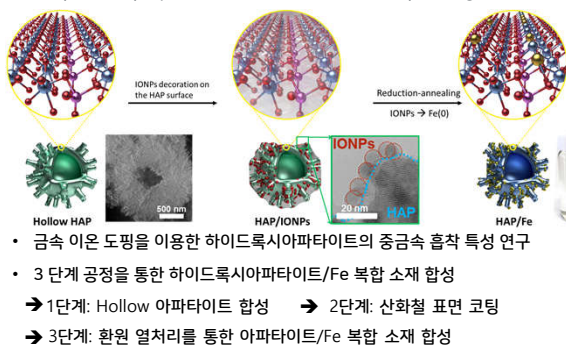


▪ Perovskite Tandem solar cell 구조

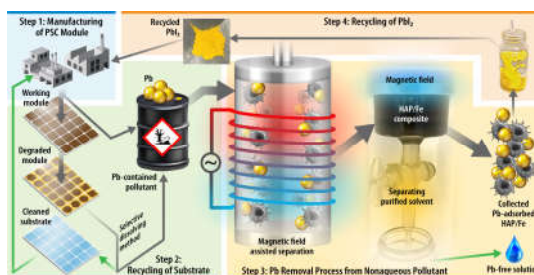


◆ 신재생 에너지 및 환경 소재

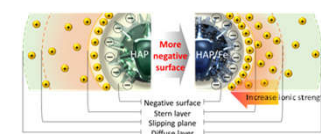
□ Hydroxyapatite/Fe for Pb recycling from Perovskite solar cells



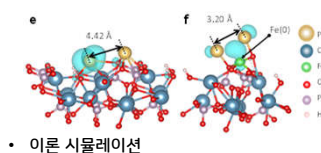
- 금속 이온 도핑을 이용한 하이드록시아파타이트의 중금속 흡착 특성 연구
- 3 단계 공정을 통한 하이드록시아파타이트/Fe 복합 소재 합성
 - 1단계: Hollow 아파타이트 합성 → 2단계: 산화철 표면 코팅
 - 3단계: 환원 열처리를 통한 아파타이트/Fe 복합 소재 합성



- 아파타이트/Fe 입자를 이용한 실제 페로브스카이트 태양전지의 납 폐수 정화 및 납 재활용 시스템



• 표면 전하에 따른 중금속 흡착 특성 변화



• 이론 시뮬레이션