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RESEARCH & COLLABORATION PROFILE

KEYWORDS: Solar (sea)water splitting | Perovskite and layered perovskite oxynitrides | Semiconductor synthesis | Selective electrocatalysts | (Photo)electrocatalysis | HER | CER | OER/ORR

RESEARCH SNAPSHOT Developing visible-light-responsive oxynitride semiconductors and (photo)electrocatalysis for efficient solar fuel production. The research integrates novel layered perovskite and perovskite oxynitride design, topotactic nitridation, defect/morphology control, and photoelectrode engineering to advance efficient and durable (sea)water splitting under neutral, chloride-containing environment.

RESEARCH EXPERTISE

- Synthesis design of perovskite and layered perovskite oxynitride semiconductors
- Novel synthesis route, doping engineering, band-gap engineering, defect control
- Two-dimensional, porous, and core-shell morphology architectures
- Solar water/seawater splitting and HER/OER/CER/ORR (photo)electrocatalysis

RECENT RESEARCH HIGHLIGHTS

- Established topotactic nitridation of La4Ti3O12 to form a core-shell La4Ti3(O,N)12@LaTiO2N photoanode for efficient photoelectrochemical water splitting (Small, 2026).
- Demonstrated chloride recirculation as a sustainable reaction pathway for solar seawater splitting over BaTaO2N photoanodes (Inorg. Chem. Front., 2026).
- Developed layered-oxide-derived, less-defective 2D and porous LaTiO2N/SrNbO2N/ANbO2N platforms for neutral seawater and water splitting (2022-2024).

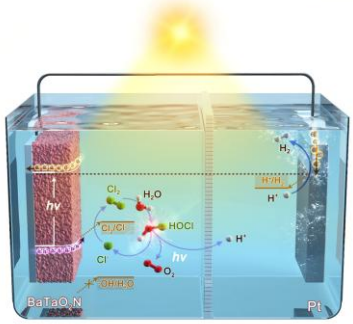
POTENTIAL COLLABORATION RESEARCH

Best-fit partners: solid-state chemistry | spectroscopy/microscopy | computation | device engineering

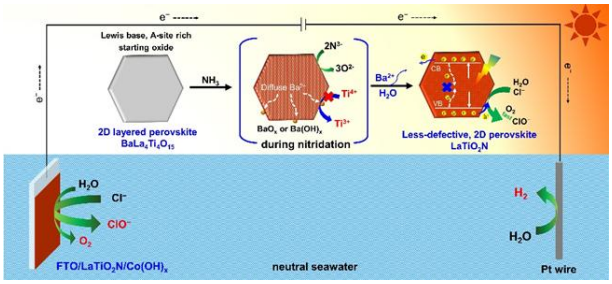
1. Joint discovery and scalable synthesis of visible-light-active oxynitride semiconductors
2. In situ/operando structural and spectroscopic analysis of nitridation, defects, and photocatalysis
3. Integration of photoanodes with OER/CER/ORR catalysts for selective solar (sea)water splitting
4. Durability testing and device development under neutral and saline operating conditions

SELECTED RECENT PUBLICATIONS

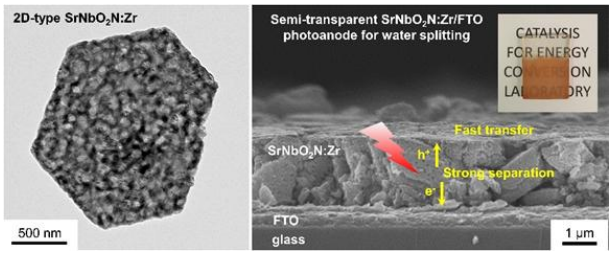
1. **J. Seo*, Y. Seo, O. Kwon, M. Ki, W. Lee.** "Topotactic Nitridation Enabled Core-Shell La4Ti3(O,N)12@LaTiO2N for Efficient Photoelectrochemical Water Splitting." *Small*, 22 (2026) e74514
2. **J. Seo*, S. Mun, V.-H. Trinh.** "Sustainable Solar Seawater Splitting over a BaTaO2N Photoanode Enabled by Chloride Recirculation." *Inorg. Chem. Front.*, 13 (2026) 51-62



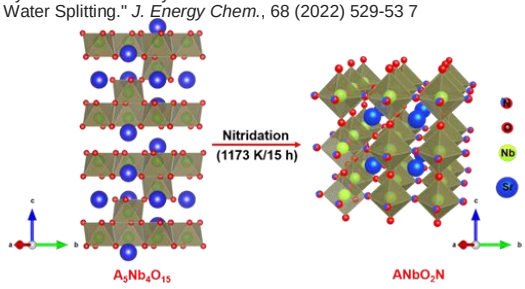
3. **T. T. T. Tran, J. Seo*.** "Enhanced Neutral Seawater Splitting on Less-Defective, Two-Dimensional LaTiO2N Photoanodes Prepared from Layered Perovskite BaLa4Ti4O15." *J. Mater. Chem. A*, 12 (2024) 17128-17141



4. **V.-H. Trinh, J. Seo*.** "Porous Cuboidal SrNbO2N Crystals Grown on a Nb Substrate as an Active Photoanode for Neutral Seawater Splitting under Sunlight." *ACS Sustain. Chem. Eng.*, 11 (2023) 1655-1665
5. **T. T. T. Tran, V.-H. Trinh, J. Seo*.** "Two-Dimensional Perovskite SrNbO2N with Zr Doping for Accelerating Photoelectrochemical Water Splitting." *J. Mater. Sci. Technol.*, 142 (2023) 176-184



6. **S. Ramaraj, J. Seo*.** "Intensive-Visible-Light-Responsive ANbO2N (A = Sr, Ba) Synthesized from Layered Perovskite A5Nb4O15 for Enhanced Photoelectrochemical Water Splitting." *J. Energy Chem.*, 68 (2022) 529-53 7



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INTEGRATED MATERIALS-TO-PHOTOCATALYSIS RESEARCH STRATEGY

