

# Designing Nanomaterials for Energy Conversion and Biomedical Application

## Research Topics

### Solar to Fuel Energy Conversion

- Investigating transition metal chalcogenides for electrocatalytic water splitting.
- Understanding mechanistic details through exploration of molecular coordination complexes.
- Optimizing catalytic efficiency through controlling the chemical potential around the catalytic sites.
- Investigating nanotube and nanorod arrays for photoelectrochemical solar energy conversion.

### Electrocatalytic CO<sub>2</sub> Reduction

- Designing electrocatalysts for CO<sub>2</sub> conversion to value-added chemicals through hypothesis-driven bottom-up approach.
- Understanding structure-property correlation for selective CO<sub>2</sub> reduction to carbon-rich products through single atom catalysts.

### Designed Synthesis of Non-enzymatic Biosensors

- Investigating transition metal selenides and tellurides for direct electrochemical sensing of dopamine, serotonin, glucose etc..
- Understanding mechanistic details for analyte selectivity through exploration of compositional phase diagram.

### PoC

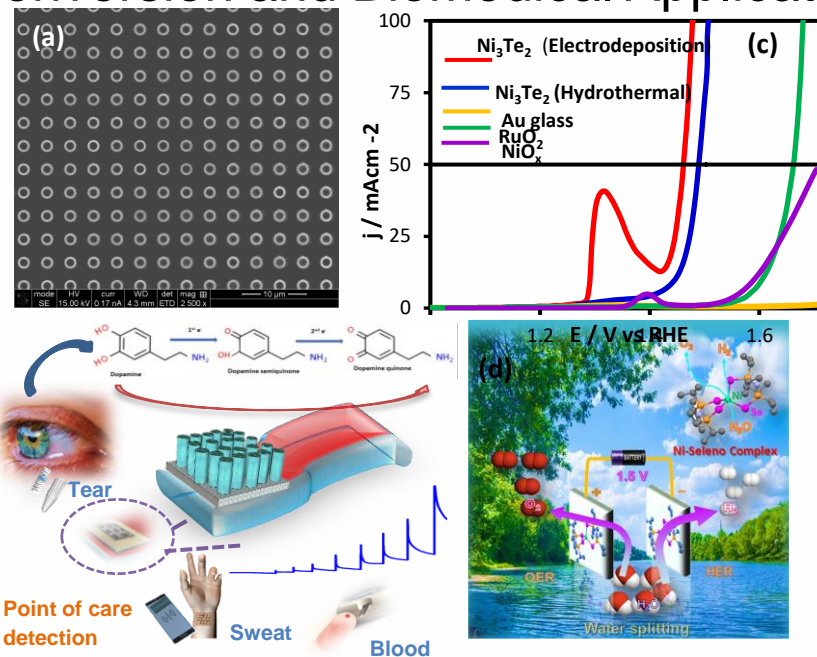
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(a) Nanostructure Arrays, (b) biosensors and (c, d) water electrolyzers

## Keywords

- Solar energy conversion; water electrolysis, nanomaterials; solar-to-fuel energy conversion; nanobiosensors; non-enzymatic sensors; oxygen evolution reaction.

## Recognitions/Significant achievements

- Highly cited author in Royal Society of Chemistry.
- <https://phys.org/news/2016-12-approach-hydrogen-production.html>
- Liyanage, W. P. R.; **Nath, M.** "CdS-CdTe Heterojunction Nanotube Arrays for Efficient Solar Energy Conversion" *J. Mater. Chem. A*, 2016, 4, 14637-14648.
- Swesi, A.; Masud, J.; **Nath, M.** "High-Efficiency NiSe Based OER Catalysts for Water Electrolysis" *Energy and Environ. Sci.* 2016, 9, 1771.