

Hierarchical Meso-structures for Environment Cleanup System & Energy Storage

Keywords: Nanoscale, Fuel Cell, Biocaptors, Sensors, Capacitors, Catalysts

Sherif El-Safty

Managing Researcher, Research Center for Functional Materials

Sherif.ELSAFTY@nims.go.jp | https://samurai.nims.go.jp/profiles/sherif_elsafty



- Background**
- The environment protection, recognition, preservation of hazards and pathogens.
 - Fuel cells-based electrode powering EVs with high power densities and zero emissions.
 - Hierarchy nano-architectures for high capacitance, long-term stability and reproducibility of energy storage devices

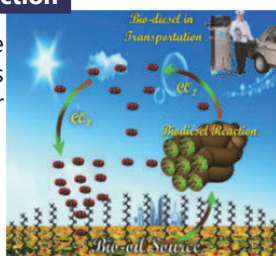
- Aim**
- Environmental Remediation (nano for simple removal/detection of radioactive and toxins)
 - Petrochemical catalysts and natural gas production
 - Energy Storage, Fuel cell & Capacitors
 - Simple extraction based nano-captor technique of REE metals

Advanced Research Topics

Nanocatalyst biodiesel production

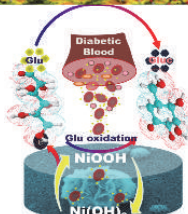
Fabrication of thermal/ stable nanocatalytic composites leads to biodiesel production for transportation with features

- High product yield >> 80%
- Cost-effective production
- Long-term reusability



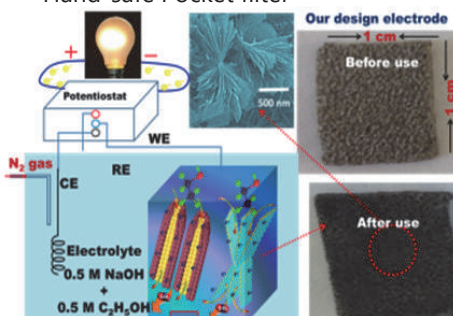
Glucose sensor for diabetic blood

Our portable sensor enabled highly sensitive and selective recognition of glucose from diabetic blood



Fuel cells for sustainable energy

Design, low-cost, Pt-free electrodes based on homogeneous organic/inorganic catalyst for alcohol electro-oxidation reaction (AOR), compared to conventional (Pt/C) electrodes. Our design offers superior current oxidation density, low onset potential & charge transfer capacitance, long-term stability & reproducibility, and low cost energy production.



- Publications**
- El-Safty, et al. Scientific Reports 2016, 6, 24330
 - El-Safty et al. Scientific Reports, 2018, 8, 3740
 - El-Safty et al. Chemical Communications, 2014, 50, 1356

Applied area and future prospects

- Developed optical & electrochemical sensors
- Selective and sensitive removal materials of radioactive isotopes
- Petrochemical catalysts and natural gas
- Fuel cell and energy storage & capacitors

Issues for technology transfer

- Scale-up 10-inch 3 electrode-catalyst porotypes
- Materials for sensor kits; ii) Tea bags; iii) pellets; iv) masks ; and v) Nano-filter
- Biodiesel production catalysts
- Selective extractor for REE

Real water purification in house kits



Our developed Technology Providing: i) Sensor kits; ii) Tea bags; iii) Pellets; iv) Masks ; and v) Nano-filter for

- Visual and early warning for toxic & radioactive
- Safe drinking water
- Hand-safe Pocket filter