19th TcSUH STUDENT/POSTDOC SEMINAR

Monday, April 17, 2023 - 5:00 pm, HSC 102

or join by Zoom:

(Meeting ID: 263 324 2787): https://tinyurl.com/2p9de9zh

Meet & Greet: Food and soft drinks will be served at **4:30** *p.m!! (RSVP)*

Device-level optimization of n-type $Mg_3(Sb, Bi)_2$-based thermoelectric modules toward applications: a perspective

Congcong Xu

Department of Physics and TcSUH

Abstract: Thermoelectric material performance has been considerably improved in recent decades. However, device-level optimization for the large-scale application of materials remains challenging. First, high zT values do not guarantee excellent device performance since material-level property enhancements can be countered by poor interfacial contacts at the device level. Second, maintaining high zT over a wide temperature range is always difficult, so it is worth considering how to maximize overall energy conversion efficiency through structural optimization at the device level when the material's performance is pushed to its limit. Proper structure design, including size matching for the n- and p-type thermoelectric legs, heat exchange, and space utilization, is crucial to the device's performance. Finally, reliability issues, manufacturing costs, and device assembly techniques are equally important when considering large-scale applications. To address these issues, here we focus on modules based on n-type $Mg_3(Sb, Bi)_2$, one of the most commercially promising thermoelectric materials, and discuss the influence of parameters on the modules and the corresponding device-level optimization strategies.

Bio: Mr. Congcong Xu is a group member under the supervision of Prof. Ren in the Department of Physics and TcSUH at the University of Houston. He has just received his Ph.D. degree in this semester. His current research focuses on thermoelectric materials and devices.

Fe doping and electrochemical reconstruction in $Ni\&Ni_{0.2}Mo_{0.8}N$ for large current density alkaline seawater electrolysis

Minghui Ning

Department of Physics and TcSUH

Abstract: The industrial scale of fresh water electrolysis to produce hydrogen (H_2) will make the shortage of fresh water resource even worse. Seawater, which consists of 97% of the water resource on earth, is much more abundant for water electrolysis. However, the presence of Cl^-, Ca^{2+}, and Mg^{2+} causes several critical problems for the seawater electrolysis. Firstly, the presence of Cl^- introduces chloride oxidation reactions as the competitive reactions for oxygen evolution reaction (OER) at the anode side. The chloride oxidation reactions are undesired since the produced Cl_2 or ClO^- will eventually become excessive and pollutants to the environment. Secondly, the existence of Ca^{2+} and Mg^{2+} ions will precipitate as $Ca(OH)_2$ and $Mg(OH)_2$ then cause blockages on active sites of catalysts, ion exchange membrane or diaphragm, and the flow channels of electrolyzer. In this presentation, we will introduce the Fe doped $Ni\&Ni_{0.2}Mo_{0.8}N$ as highly active and selective seawater electrolysis catalyst. The

electrochemically reconstructed Fe, Mo co-doped NiO worked as an efficient alkaline OER catalyst to thermodynamically suppress the chloride oxidation reactions. The Ca^{2+} and Mg^{2+} were removed from seawater *via* a simple pretreatment to avoid the precipitation of $Ca(OH)_2$ and $Mg(OH)_2$ and achieve the long-term and sustainable seawater electrolysis.

Bio: Mr. Minghui Ning is currently a Ph.D. student under the supervision of Prof. Ren in the Department of Physics and TcSUH at the University of Houston. His current research focuses on seawater electrolysis.

Tailoring the Size, Shape, and Crystallinity of Iron Oxide Nanoparticles for Studies of Nano-Magnetism and their Potential Applications

Minh Dang Nguyen

Department of Chemistry and TcSUH

Abstract: The design and fabrication of magnetic iron oxide nanoparticles (IONPs) with desired magnetic properties by tailoring their sizes, shapes, and crystallinity is critical for advancing the field of magnetic nanomaterials and their corresponding applications in biosensing and biomedicine. In this work, we focused on developing synthetic methods capable of producing highly crystalline iron oxide nanospheres (IONSs) having a wide range of sizes (50–390 nm diameters) and controlling their crystallinity without changing their size. The highly crystalline IONSs exhibited markedly enhanced ferrimagnetic (FM) properties, and our ability to control the crystallinity of the IONSs was useful in preparing IONSs with desired properties ranging from ferromagnetism (FM) to superparamagnetism (SPM). In related studies, SPM single crystal IONSs (5–20 nm diameters) were assembled into large super-particles for studies of nano-magnetism with the expectation of unique and potentially useful magnetic behavior.

Bio: Mr. Minh Dang Nguyen is a Ph.D. candidate (4th-year) in the Department of Chemistry, NSM, University of Houston under the supervision of Professor T. Randall Lee. His research focuses on the synthesis of magnetic iron oxide nanoparticles having different sizes and shapes for studies of their magnetic properties for biosensing and biomedicine. He obtained his BSc degree in Advanced Materials Science and Nanotechnology from the University of Science and Technology of Hanoi.

Join Zoom Meeting (Meeting ID: 263 324 2787): https://tinyurl.com/2p9de9zh
RSVP BY Friday, April 14th at 3:00 p.m. for Pizza from Domino's (for the seminar attendees), Drinks, and Snacks: https://forms.office.com/r/2PzKGySbXx

Persons with disabilities who require accommodations to attend this seminar should call 713-743-8212