RESEARCH BRIEF
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NAWI National Alliance for Water Innovation

Platform Process for Electrified Pretreatment

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Challenge

Chemicals used in desalination are mostly generated off-site using energy-intensive methods and, when accounting for the transportation costs, account for a significant fraction of the operational and greenhouse gas emissions.[1] Processes such as electrocoagulation have shown promise as substitutes for chemical addition, but their exact mechanism of action is poorly understood. Developing a thorough understanding of how these electrochemical processes work will allow researchers and engineers to optimize the processes and ultimately displace chemical use.

Research Approach

In this project, we have developed an experimental methodology that combines probing electrochemical reactions and surfaces at the atomic, nano, and micron scale using an array of characterization tools, and use these observations/insights to better understand macro-scale (i.e., system-wide) electrochemical characterization methods. While these characterization methods have been applied to other systems (e.g., energy storage), they have never been applied in a concentrated effort to characterize reactions and electrode surfaces during the electrochemical treatment of water.

Impact

The long-term goal of the NAWI research on electrified treatment processes is to establish the scientific foundation of electrified processes and research opportunities for highly energy-efficient water treatment and pretreatment for NAWI's Electrification theme. The outcome of this project will provide unique insights that will enable the wide-scale adoption of these treatment methods across multiple treatment scenarios. It is expected that the tools and insights developed in this work will pave the way towards a deeper understanding of other electrochemical platforms and processes for water treatment.

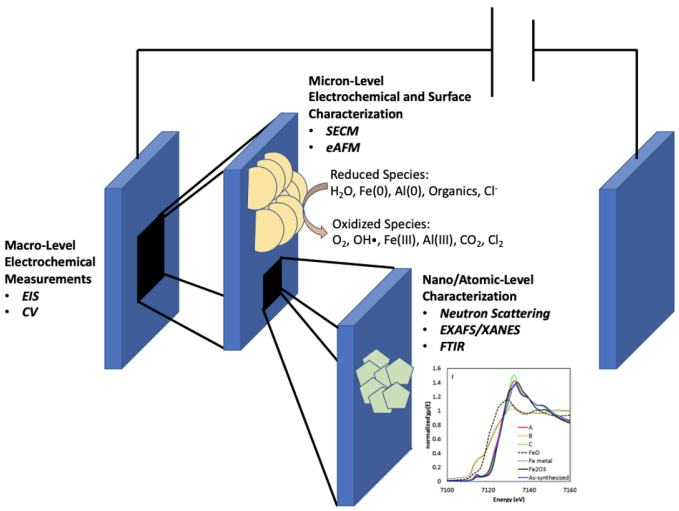

Figure 1. Investigation of electrochemical reactions from the macro to the atomic scale utilizing a range of advanced characterization methods. The combination of these methods will enable more efficient operation, as well as identify limitations, and potentially open up completely new areas of application.

RESEARCH PARTNERS

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REFERENCES

1. C. M. Khor, J. Wang, M. Li, B. A. Oettel, R. B. Kaner, D. Jassby and E. Hoek, Water, 2020, 12, 3426.

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