UNIVERSITY OF CALIFORNIA, IRVINE

THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

Is Proud to Host a Seminar by:

Sr. Materials Research Engineer

Brandice Weathers

Center for Corrosion Science and Engineering

U.S. Naval Research Laboratory (NRL)

Thursday, December 1, 2022

2:00-3:20 PM

Zoom Meeting ID: 928 5767 0106, Passcode: 541893

ELECTROCHEMICAL CORROSION—A NAVAL PERSPECTIVE

Abstract: Corrosion has an impact of over $8 billion annually just for the Department of Navy. While the financial impact is significant, mission impacts to safety, productivity and fleet readiness are also critically important. Corrosion can be simply defined as any degradation of a material or loss of material property because of the influence of its environment; however, corrosion of metal alloys due to exposure with seawater is the most common scenario in naval applications. Complicating factors such as complex ship systems, varying exposure environments and material interactions make material selection difficult. This presentation will provide two examples of electrochemical research topics that address relevant naval knowledge gaps and can be used to help guide appropriate material selection. The first topic is a tribocorrosion investigation where the combined effects of sliding wear and anodic dissolution on the passivation response of two duplex stainless steels is examined. The work illustrates that the strain state induced by mechanical stresses during combined sliding and corrosion change the anodic kinetic response for ferrite and austenite. The second topic is an in-depth examination of long-term open-circuit potential behavior and galvanic compatibility for a broad array of marine grade materials. A key finding was that several highly alloyed, corrosion resistant stainless steels were susceptible to crevice corrosion when exposed at open circuit. The ennoblement of these alloys in seawater seemed to play a role in crevice corrosion initiation, and the loss of ennoblement provided an indication of the onset of crevice corrosion. The findings also show that relative open-circuit potential difference on the galvanic series is not an adequate long-term predictor of material compatibility and that rate information, both cathodic and anodic kinetics, are necessary for a comprehensive understanding of galvanic compatibility.

Bio: Brandice (Brandi) Weathers is currently a senior materials research engineer in the Center for Corrosion Science and Engineering, Code 6136, at the U.S. Naval Research Laboratory (NRL). While at NRL, she has worked in the areas of cathodic protection, material compatibility, and impressed current cathodic protection electrode design. She received her Ph.D., M.S, and B.S. in materials science and engineering from The University of Tennessee, Knoxville. As a graduate student she examined localized corrosion behavior of zirconium based amorphous alloys in chloride electrolytes. She serves as the Corrosion and Cathodic Protection System Integration Team Lead for a naval platform and an Engineering Manager for Design of Cathodic Protection Systems at the Naval Sea Systems Command. Weathers' research considers material interactions in a marine environment, focusing on environmental effects and electrochemical processes. These efforts are ultimately to assist in reducing corrosion impacts on naval vessels. She was the principle author of the NAVSEA document - Ships Corrosion Control Design Practice Criteria (CCDPC) Manual (T9070-B1-DPC-010/630-1). This document represents a 3-year effort, which she documented and codified essential corrosion control design requirements and recommendations for the design of naval sea platforms. Weathers received the Professional Achievement in Government Award at the 2022 Black Engineer of the Year (BEYA) Science, Technology, Engineering, and Math (STEM) Conference.