

MASTER 2 INTERNSHIP / FINAL-YEAR ENGINEERING PROJECT

Accelerated Corrosion Screening of Thin-Film Coatings in Molten Salts

Level: Master 2 or final-year engineering student	Host laboratory: Laboratoire de Réactivité de Surface (LRS) CNRS Sorbonne Université	Collaboration: CEA Saclay
Duration: 5-6 months, depending on the academic calendar	Field: Electrocatalysis / spectroelectrochemistry	PhD continuation: possible

CONTEXT AND OBJECTIVES

The development of corrosion-resistant metallic coatings increasingly relies on combinatorial synthesis, in which compositionally graded thin films provide rapid access to broad composition ranges. Yet environmental stability is often evaluated only after materials selection. This internship is part of a broader strategy aimed at integrating corrosion resistance directly into accelerated materials discovery. The work will be carried out at LRS, in collaboration with CEA. A complementary activity at CEA is dedicated to the fabrication of metallic, multicomponent and architected coatings by magnetron sputtering. The present internship will develop the spatially resolved, high-temperature corrosion methodology needed to evaluate these materials in molten-salt environments and to generate composition-microstructure-corrosion relationships.

PROPOSED WORK

- Finalize and validate a Raman microdroplet spectroelectrochemical cell for high-temperature operation, progressing from room temperature toward approximately 500 °C in selected molten-salt environments. Particular attention will be paid to cell geometry, temperature control, optical access, electrochemical configuration, signal stability and reproducibility.
- Establish robust corrosion protocols on model metallic materials and representative sputtered thin films, using open-circuit potential, polarization measurements and electrochemical impedance spectroscopy when appropriate.
- Use in situ/operando Raman microspectroscopy to identify and follow surface films, soluble corrosion products and interfacial chemical transformations as a function of temperature, potential and material composition, and correlate these signatures with the electrochemical response.
- Apply the validated methodology to compositionally graded, multicomponent or architected coatings produced in collaboration with CEA. Spatially resolved measurements will be used to map corrosion and passivation behaviour across material libraries and relate local performance to composition and microstructure.
- Structure the resulting common dataset and test first data-driven and machine-learning models linking processing parameters, composition and materials descriptors to corrosion performance. The objective is a proof of concept: identify relevant descriptors, assess predictive trends and determine which additional experiments would provide the most information.

Techniques: microdroplet electrochemistry, in situ/operando Raman microspectroscopy, high-temperature spectroelectrochemistry, polarization measurements, electrochemical impedance spectroscopy, molten-salt corrosion, spatially resolved screening, materials datasets and introductory machine-learning analysis.

CANDIDATE PROFILE

Master 2 student or final-year engineering student in physical chemistry, electrochemistry, materials science or a related field. A solid experimental background and interest in corrosion, electrochemical interfaces and spectroscopy are expected. Rigor, autonomy and the ability to work effectively in a collaborative environment are essential. An interest in data analysis and machine learning would be an advantage. A good command of scientific English is required.

SUPERVISION AND PHD CONTINUATION

Supervision at LRS: Vincent Vivier, Mireille Turmine. The internship will be carried out at LRS, in collaboration with CEA (Paul Foulquier, Frédéric Schuster). It constitutes preliminary work for a broader project on accelerated discovery of corrosion-resistant coatings for molten-salt and other extreme environments.

A possible continuation as a PhD thesis is envisioned.

CONTACT

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