PROJECT CATEGORY: Materials & Industrial Processes

STARTUP: Mattiq (formerly Stoicheia)

WEBSITE: https://mattiq.com

PROJECT TITLE: High-Throughput Discovery of Catalysts for the Energy Transition

PROJECT DESCRIPTION

The project will involve the synthesis and screening of low Platinum group metal (PGM) catalysts candidates in search of cheaper, more efficient, and more abundant electrocatalysts for fuel cell applications. Stoicheia is working independently and with partners to leverage our high-throughput technology to discover new and enabling electrocatalysts for renewable technologies; fuel cell catalysts is one of the major focus areas for our internal development. This project can involve both scientific explorations of new methods for synthesizing Pt-based alloys, as well as engineering optimization to increase the robustness of our catalyst screening technologies.

JOB EXPECTATIONS:

Depending on experience and interest, the student will play a critical role in one of the following three areas: 1) high-throughput synthesis of nanocatalyst materials containing low PGM content, 2) high-throughput electrochemical characterization of nanocatalyst materials, or 3) atomistic modeling of surface characteristics supplemented with machine learning algorithms to enhance predictive capabilities. The responsibilities for each of the previous three areas are as follows:

1. High-throughput synthesis:
    a. Conducting experiments to synthesize catalyst libraries
    b. Optical microscopy characterization of catalyst libraries
    c. Preparation of electrode materials for catalyst deposition
    d. Detailed record keeping and inventory tracking
    e. Presenting results and providing recommendations for future experiments

2. High-throughput screening:
    a. Conducting experiments to characterize catalyst performance of catalysts within libraries
    b. Preparation of electrolyte and electrodes for testing
    c. Detailed record keeping and inventory tracking
    d. Presenting results and providing recommendations for future experiments

3. Atomistic modeling + machine learning
    a. Implementing methods for modeling catalyst surfaces and activities
    b. Optimizing data structure for input into machine learning models
    c. Coupling computational data with measured catalyst data
    d. Working with our data science team to optimize back-end infrastructure
    e. Presenting results and providing recommendations for future experiments

DESIRED EXPERIENCE:

- Currently enrolled in undergraduate or graduate program chemistry, materials science, chemical engineering, computer science, mechanical engineering, or related field
- Some laboratory skills related to materials science or chemistry, or computational modeling experience (DFT, Monte Carlo, etc.), or machine learning/data science experience
- Strong problem-solving skills
- Strong written and verbal communication skills

TIME COMMITMENT:

We expect at least 40 hrs/week during the 8 week period. We are typically flexible on how these hours are achieved, but ideally the student would acquire the 40 hrs each week within the 7 am - 7 pm time window.

TRAINING MENTORING:

1. Initial Meeting:
    - The intern will meet with the project supervisor to discuss the project goals and objectives, as well as the expectations for the internship.
    - The intern will be provided with a project overview, including relevant background information, literature review, and experimental protocols.
    - The intern will be given a tour of the lab facilities and introduced to the lab equipment and procedures.
2. Weekly Progress Meetings:
    - The intern will meet with the project supervisor on a weekly basis to discuss progress, any challenges encountered, and next steps.
    - The supervisor will provide guidance and feedback on the experimental design and data analysis.
    - The intern also can ask questions and receive feedback on any challenges they may be facing.
3. Bi-weekly Research Presentations:
    - The intern will be required to give presentations on their research progress and findings to the lab group and other relevant stakeholders with the rest of the research team.
    - The supervisor will provide feedback on the intern's presentation skills and will help the intern to improve their communication and presentation skills.
4. Final Report and Presentation:
    - The intern will be required to prepare a final report and give a final presentation on their research project.
    - The supervisor will provide feedback on the report and presentation and will help the intern to prepare for the final submission.
5. Evaluation and Feedback:
    - At the end of the internship, the supervisor will provide the intern with an evaluation and feedback on their performance.
    - The intern also can provide feedback on their mentoring experience and the internship program.

Feedback will be given informally regularly during the internship, as well as with two formalized sessions, one occurring halfway through the internship and a written evaluation occurring at the end of the internship, both containing a performance review of the intern’s progress and work. The development of the intern will focus on improving problem solving skills in a professional engineering context, solidifying verbal and written technical communication, and emphasizing collaborative engineering work.