Summer Research Projects UiO: Energy and Environment 2026

Title of the project:

High-Entropy Alloy–Based Materials for Sustainable Hydrogen Storage Towards the Atacama Large Aperture Submillimetre Telescope

Brief Description of the Project:

This project focuses on the synthesis and characterization of high-entropy alloy–based materials for sustainable hydrogen storage, supporting clean-energy technologies relevant to the Atacama Large Aperture Submillimetre Telescope (AtLAST 2). The work develops efficient, earth-abundant materials through an interdisciplinary approach combining materials science, chemistry, and energy engineering.

Name of Supervisor(s):

Supervisor: Yogesh Kumar Yadav (Researcher)

Co-supervisor: Prof. Sabrina Sartori

Preferred Background of Candidate(s):

Master's students with background in materials science, physics, chemistry, metallurgy, or energy-related engineering. Prior experience in materials characterization (XRD, TEM SEM, EDS hydrogen storage measurements) is desirable but not mandatory.

Number of Available Projects:

1

Preferred Project Period:

6 weeks full-time (May–August 2026)

Outline of Project Work:

The student will be actively involved in the design, development, and systematic investigation of high-entropy alloy (HEA)–based materials for hydrogen storage applications. The project will begin with a comprehensive literature review to understand the current state of hydrogen

storage technologies, the fundamental principles of high-entropy alloys, and their emerging role for hydrogen storage applications in the context of AtLAST 2. Based on this understanding, suitable elemental combinations will be selected by considering factors such as hydrogen affinity, thermodynamic stability, elemental abundance, cost, and environmental sustainability. The project will cover different synthesis methods for high-entropy alloys, including basic solid-state or mechanical alloying approaches, with emphasis on how processing routes influence phase formation, microstructure, and material properties. Structural and microstructural characterization will be performed using standard techniques to evaluate phase constitution, crystallinity, and compositional homogeneity. A major focus of the project will be the evaluation of hydrogen storage behaviour, including hydrogen absorption–desorption characteristics, storage capacity, and operational conditions. In addition, sustainability aspects of material selection, such as the use of non-toxic, cost-effective, and earth-abundant elements, will be critically assessed to ensure relevance for practical hydrogen energy applications, including clean-energy solutions for AtLAST 2.

By the end of the project, the student is expected to gain a strong understanding of high-entropy alloy design principles, hands-on experience in materials synthesis and characterization, and insight into the potential of HEA-based materials for efficient and sustainable hydrogen storage to support the AtLAST 2 telescope..

Expected Outcomes:

- Deep understanding of hydrogen storage mechanisms in high-entropy alloys relevant to AtLAST 2 applications.
- Hands-on experience with interdisciplinary research in clean-energy materials, combining materials science, chemistry, and energy engineering.
- Preparation of a concise technical report and presentation summarizing experimental results, material performance, and sustainability impact for scientific and telescope-related applications.