

## Faculty of Engineering

### Summer Research Program 2024-2025

Project Title: Maximising the Oxygen Dissolution Layer of zirconium alloys for nuclear fuel cladding through thermal processing

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### Objective

Zirconium alloys are widely used as fuel cladding in water-cooled nuclear reactors due to their low neutron absorption cross section, high corrosion resistance, and sufficient mechanical properties. Recent studies suggest that during service a thin layer of zirconium forms which contains a high concentration of dissolved oxygen in addition to an oxide. This thin layer, the Oxygen Dissolution Layer (or ODL) can be replicated by heat treatments in oxygen or air. The objective of this project is to maximise the width of this zone and compare the effects of temperature, time, and gas composition on the formation of the ODL in commercial zirconium alloys.

### Project Details

The aim of the project is for the summer student to perform furnace experiments and characterise their samples in terms of microstructure, and oxide and ODL thickness. The schematic in Figure 1 shows the relative oxide and ODL thickness for a three-step heat treatment as an example.

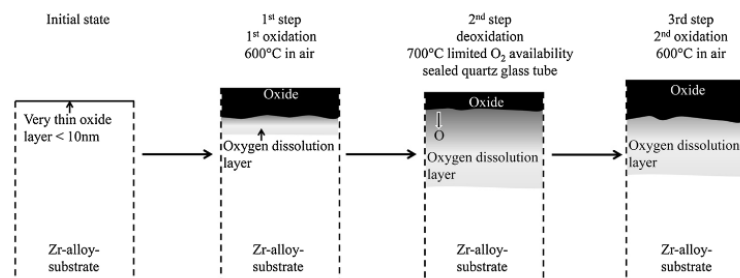


Figure 1: Example heat treatment and ODL

### Prerequisites

The student should have an interest in metallurgy and diffusion processes. Completion of MTE2102 is recommended for an understanding of phase transformations and diffusion processes but not required if the student is interested in reading up on these topics.

### Additional Information

The student will be supported by a PhD student, will become a member of the Metallurgy and Corrosion Cluster based in the Department of Materials Science and Engineering and there will be potentially an opportunity for the student to present their work to Jacobs, UK that is supporting this PhD project.