MONASH University

MONASH ENGINEERING

Faculty of Engineering
ASPIRE Summer Research Program 2026-2027

Project Title: Characterisation of Dissimilar Metal Weldments

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Objective

Characterise the micro and macro mechanical properties of dissmilar metal joints

Project Details

Dissimilar metal joints are used across a wide range of industries, including nuclear, petrochemical, and oil and gas, wherever distinct material properties are required along different regions of a continuous plant component. In nuclear power plants, for example, ferritic steels are used in reactor pressure vessels for their resistance to irradiation damage, while the cooling water leaving the reactor must be carried in corrosion-resistant piping, typically austenitic stainless steel. Consequently, somewhere in the plant the ferritic steel meets the austenitic stainless steel, forming a dissimilar metal joint through which the cooling water is carried.

Dissimilar metal welds have traditionally been produced manually, using a filler (weld consumable) metal that bonds well to both sides of the joint and, ideally, provides properties intermediate between those of the two base metals; for example, thermal expansion coefficient. Figure 1(a), for instance, shows a nickel alloy used to join carbon steel and stainless steel for nuclear applications. However, dissimilar joints are often the weakest point in the structure (see Figure1(b)), owing to the changes in alloy composition and microstructure induced by the welding process. The manual nature of the process further increases uncertainty regarding the integrity of the resulting joints.

To produce more repeatable joints using automated robotic systems, researchers have developed advanced welding technologies such as high-energy beam welding; for example, electron beam or laser beam welding. Although economically attractive, these processes cannot be deployed industrially until the characteristics of the joints they produce have been fully investigated. This includes detailed micromechanical studies, such as the morphology and size of grains within the weldment and their chemical composition and mechanical properties, which may be altered due to differing fusion rates of the elements melted during welding.

Project Timeline

TASK	1	2	3	4	5	6	7	8	9	10
Literature review										
Training on the equipment										
Producing samples and polishing										
Micromechanical characterisation										
Macromechanical testing										
Writing up										

Prerequisites

N/A

Student Placement Agreement

A student placement agreement must be signed by the project supervisor and the student prior to commencement of the ASPIRE program.

[LV0554-72741 ASPIRE Program Co-Curricular-Student-Placement-Agreement-Short-term.docx]

Additional Information

See attached

Submit as a word document - no more than one page long.