

An Indian-Australian research partnership



Industry sponsored project by CSIRO

Project title: High Performance Light Alloys Through Non-Equilibrium Processing

Project number: IMURA0180

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Research Academy theme/s

List only the research academy theme/s that is relevant to the project

5. Nanotechnology

The research problem

There are a number of emerging and established processes and alloy systems that generate metal microstructures far from equilibrium in character. The evolution of novel processes such as pulsed current sintering, and of unique alloy systems such as the Bulk Amorphous Metals, together with widespread industrial practices such as die-casting, all draw heavily on non-equilibrium phenomena.

The Project will focus on the development of non-equilibrium phase diagrams for certain commercially important alloy systems.

This project will use NMR, XRD and both electron and optical microscopy to determine the solute and precipitate distributions within selected alloys, solidified at different rates and having undergone various thermal treatments. The appropriate non-equilibrium phase boundaries will be identified on a phase diagram and enable the prediction of optimum alloy compositions for targeted property solutions to be identified. The work will focus initially on selected Al and Mg alloys.

Expected outcomes

Identification of non-equilibrium phase fields for consequent optimisation of alloy compositions in order to generate chemical and mechanical properties that far exceed the current generation of alloy properties. Publications in the open literature.

Specific Milestones and Deliverables

- Literature search on non-equilibrium phase diagrams for metal systems.
- Design and commissioning of a casting vessel that permits accurate control of metal solidification and cooling rate.

- Selection, melting and casting of different 'suites' of alloy compositions.
- Perform thermal processing of selected alloy systems
- Use of analytical techniques to identify non-equilibrium phase fields.
- Undertake a number of physical and chemical tests on selected alloys.