IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**DEVELOPMENT OF ULTRA-LIGHT AND ULTRA-FINE GRAINED Mg-Li-Ca ALLOY BY COMPOSITIONAL OPTIMIZATION AND SEVERE PLASTIC DEFORMATION**	
Project Number	**IMURA0280**	
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?
(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

In view of the demand for light structural materials for a range of applications, including the transport and biomedical industries, there is a need to utilize very light metals and produce their alloys so as to manipulate their properties in a controlled manner. Magnesium is promising light structural material, as evident from the vast literature appearing at present time. Alloying of Mg with Li and Ca opens up interesting avenues to produce exceptionally light structural materials for applications in automotive and other high tech industries.

Project aims

This project will therefore involve making some binary and ternary alloys of Mg, Li and Ca in the hypoeutectic, eutectic and hypereutectic compositions ranges of two- phase and single-phase structure. Of particular interest are compositions leading to body-centred cubic crystallography of the alloys, which promises higher ductility. Based on the roles played by the constituent phases during deformation, the alloys of selected compositions will be subjected to severe plastic deformation (SPD) by equal channel angular pressing (ECAP) and other SPD techniques for extreme grain refinement – down to deep submicron range. By exploiting extensive integration of knowledge in physical and mechanical metallurgy, the composition and deformation conditions will be selected with an objective of getting ultra-light nanocrystalline Mg-based alloys.

Expected outcomes

Novel ultra-light Mg-based alloys with a superior properties profile will be developed and characterised. It is expected that these alloys will find applications in automotive parts and biomedical implants.

How will the project address the Goals of the above Themes?

The project will contribute to the development of processing techniques based on severe plastic deformations and leading to nanostructuring of the bulk of the material. It will help introducing nanotechnologies for large-scale structural applications.

Capabilities and Degrees Required

It is expected that the successful candidate will have a strong background in physical metallurgy, including a profound understanding of relationships between the microstructure and the mechanical properties of metals and alloys, good grasp of thermodynamics of materials, and demonstrated experimental skills in the areas of mechanical testing and microscopy.