

An Indian-Australian research partnership

Project title: A study of CO₂ sequestration in basalt formation

Project number: IMURA0111

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Research Academy theme/s

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

1. Infrastructure engineering
2. Clean Energy

The research Problem Project Title

Geological CO₂ sequestration is rapidly gaining momentum as a way of capturing carbon dioxide (CO₂) from large point sources such as thermal power plants and Portland cement factories, and store in deep geological formations for long time (~1000 years). Storing carbon dioxide underground is considered as the most effective way for long-term safe and low cost CO₂ sequestration. There are several main types of geological reservoirs with sufficient capacity to store captured CO₂: depleted oil and gas reservoirs, deep saline aquifer reservoirs, basalt formations and un-minable coal beds. However, the most effective way to achieve large scale geo-sequestration of CO₂ is still a matter of debate. One of the schemes being considered is to sequester in basalt formations. Sequestration in basalt formations have added advantages over the other methods including saline aquifers and deep unminable coal seams because rock reacts with CO₂ forming new carbonate minerals and this will result in permanently storing CO₂ in geological time scales.

However, one of the major uncertainties with this scheme is the impact of the CO₂ on the chemical, mechanical and permeable properties of the basalt rock, and how this will impact on the successful sequestration. Answers are needed to find following questions for successful sequestration of CO₂ in those formations. In particular, what is the rate of carbonation take place? How can we enhance the rate of carbonation? What is storage capacity of those formations? This project aims to address these questions and uncertainties and provide a better understanding of the effects of CO₂ on basalt. The project will provide new data on the impact of the coupling between the CO₂ state and the mechanical response of the rock that will enable the optimum rock types and injection strategies to be determined. The project also aims to assess the likely success of geo-sequestration in basalt formations considering issues of sustainability, and safety.

Project aims

The main aims of the project

1. To investigate mechanical, chemical and permeability properties of basalt under the presence of CO₂
2. To study the CO₂ storage capacity of basalt formation in India
3. To determine the carbonation rates for various basalt rock types

These aims will be achieved through a combination of experimental observation, involving the application of unique testing apparatus, and the development of state-of-the-art numerical models.

Expected outcomes

The project will provide new data on the impact of the coupling between the CO₂ state and the mechanical response of the rock that will enable the optimum rock types and injection strategies to be determined. The project will provide new storage capacity model for determining CO₂ storage volume for various basalt formations. The project also provides data to assess the likely success of geo-sequestration in basalt formations considering issues of sustainability, and safety.

Which of the above Theme does this project address?

This project will address the main research themes on (1) Infrastructure engineering and (2) Clean Energy

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

One of the most critical environmental issues facing society is that of global warming. A major driver of global warming is the increasing concentration of carbon dioxide in the atmosphere. To tackle this problem a range of strategies will be required which are expected to include the use of renewable energy sources, improved energy efficiency, carbon sequestration and increased conservation. Most experts agree that no single solution is likely to provide a satisfactory answer to the problem, and that a rational combination of the above strategies will need to be followed. This project is concerned with clean energy and infrastructure engineering.