

RP1020

REDUCING BARRIERS FOR COMMERCIAL ADAPTION OF CONSTRUCTION MATERIALS WITH LOW-EMBODIED-CARBON

Problem

Carbon emissions from conventional concrete containing Portland cement is second only to fossil fuels. This is because for each tonne of OPC production, almost one tonne of CO₂ is released as the result of calcination of limestone and combustion of fossil fuel. About 6-7% of total man-made greenhouse gas emission is attributed to its production (Fig. 1).

An 80% reduction in carbon emissions can be achieved with use of Geopolymer concrete (GPC), an innovative alternative produced from industrial by-products such as fly-ash and slag. The major barrier to GPC adoption is the lack of both standard specification and knowledge related to its durability.

Figure 1- OPC concrete has a carbon footprint second only to the fossil fuels

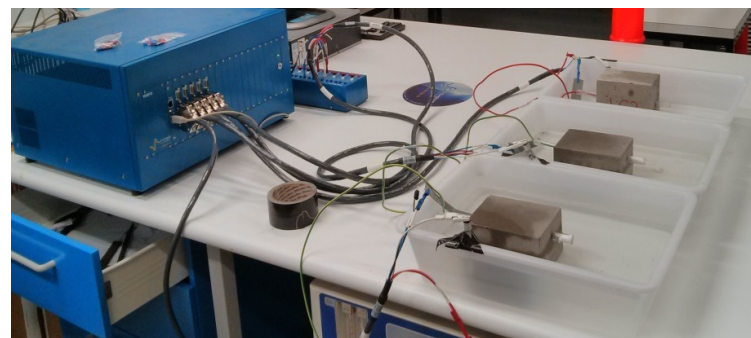


Solution

The project aims to gather field data from GPC real-life constructions to develop greater confidence in GPC use. Using the field and laboratory data, a comprehensive handbook for GPC specification will be developed and published through Standards Australia.

In addition, this work will demonstrate that GPC concretes has superior performance than OPC concrete in severe conditions such as marine environment where using OPC based concretes still leads to serious problems with millions of dollars spent for maintenance, repair or replacement of damaged structures. Corrosion experiments (Fig. 2) are carried out in order to assess the capability of these binders to protect steel reinforcement against chloride induced corrosion.

Figure 2- Electrochemical tests to monitor evolving corrosion parameters



A durable low-embodied-carbon concrete is the ultimate solution to mitigate the environmental impact of the construction industry

Benefits

According to the Australian Bureau of Statistics, the current production of pre-mixed concrete is about 27 million m³ per annum. This results in 8 million tonnes of CO₂ emissions per year.

Geopolymer alternatives can achieve from 65% to 95% carbon emission reduction, depending on the type and amount of activators used, with a typical value about 80% reduction. For a relatively moderate uptake of 10% geopolymer/concrete replacement, for example, 640 thousand tonnes per annum less carbon will be emitted to the atmosphere per year from Australia alone. This uptake will not be realised without the development of production and design guidelines for engineers and practitioners approved through Standards Australia, which this project will deliver.

Please feel free to contact the author, if you have any suggestion / enquiry about this project.

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