CO₂ Concrete

Professor Vivian Tam
Associate Dean (International)
School of Computing, Engineering and Mathematics
Professor Vivian WY Tam

Research Interest: Sustainable construction, Green buildings, life-cycle analyses, recycled concrete

Editor
International Journal of Construction Management, Taylor and Francis Group

1 of 184 College of Experts employed by the Australian Research Council (ARC), Australian Government

Competitive research funding: Awarded 36 research grants (totalled AU$2.5 million), including two ARC Discovery Project, Life cycle analysis for green building implementation.

Research outcomes: 2 books, 19 book chapters, 227 refereed journal articles and 121 refereed conference papers.

Research impacts: Hirsch Index of 40 (Scopus), 52 (Google Scholar), i10 index of 154 (Google Scholar), a total of 4,714 citations (Scopus), and 9,688 citations (Google Scholar).
Why Recycled Concrete cannot currently be used for Structural Applications?

• Weak points such as old cement paste attached to old virgin aggregate;
• Possible pre-cracked aggregate;
• Frail interfacial transition zone;
• Poor grading;
• High porosity;
• Low density; and
• High water absorption.
Keys for using Recycled Concrete for Structural Applications

Suitable Physical and Mechanical Properties

- Recycled concrete must match or surpass qualities of virgin concrete.

Real world practicality

- Concrete can be delivered in a timely and achievable manner similar to virgin concrete. Recourses required in these methods must be readily available.

Cost efficiency
CO$_2$ Concrete
This benefits the environment in two ways:

- Using carbon dioxide which would otherwise be released into the atmosphere, worsening global warming and climate change issues; and

- Reducing landfill space by turning construction waste into construction material, i.e. recycled concrete whose performance is similar to virgin concrete.

This process can bring direct benefits to concrete batching plants as recycled concrete can be effectively used. Many leading concrete suppliers have researched this capability but none have been successful.
Phenolphthalein indicator test

Differential scanning calorimetry (DSC)

X-ray powder diffraction

Differential scanning calorimetry
Old mortar attached

Old virgin aggregate

$\text{CO}_2$ enters the old mortar pores and makes it stronger
Carbonated RCA Compressive Strength Calculation based on an MLP ANN trained and tested using a 49 registers data set for the specific characteristics:
- Dosage Method: British
- Use of Admixture: No
- Use of Two Stages: No
- Aggregate type: MRA
- Cement type: GB

Water / Cement ratio:
RCA percentage:
Chamber time:
Chamber pressure:
Cement:
Water:
Sand:

Calculate CS

Compressive Strength

MPa

OK

Compressive Strength Optimisation Mix

Compressive Strength to be achieved:
Choose a value between

Parameters to be optimised:

W/C ratio:
RCA %:
CT:
GP:
Cement:
Water:
Sand:

Choose a value between
Choose a value between
Choose a value between
Choose a value between
Choose a value between
Choose a value between
Choose a value between

Best Mixtures

Desired Compressive Strength: MPa
Matures found: 5
Moving Forward

- Commercialisation?

- Impact to the Environment / Economy / Society
Project leader, Top 8 research teams selected by Innovyz Institute, Pty. Ltd. for a Waste and Recycling Technologies Program under 1.5 million support by Green Industries SA

Founded EcoBond Pty. Ltd.

EcoBond Pitching

World’s first CO2 Concrete: Biosecurity Platform

Upscale CO2 Concrete: 4 3m x 3m slabs

9-month intensive training on commercialisation and research development skills
Term 1 is validating and expanding technologies;
Term 2 is defining commercialization paths;
Term 3 is for investment strategies and capital raising activities.
We have invented CO₂ Concrete, which is a new process for producing strength recycled concrete. We inject carbon dioxide into recycled aggregate bonding, and thus performance of recycled concrete.

This benefits the environment in two ways:
- Using carbon dioxide which would otherwise be released into worsening global warming and climate change issues; and
- Reducing landfill space by turning construction waste into construction recycled concrete whose performance is similar to virgin concrete.

World's First CO₂ Concrete

We have cast two CO₂ Concrete Biosecurity Platforms for Hawkesbury Campus, As Western Sydney University Hawkesbury Farm has been known for its state-of-the-art agricultural research. We have now become a part of this great culture by contributing CO₂ Concrete biosecurity platforms, which are employed for boot cleaning, minimising and diseases.

We are looking for Investors, Partners and Network connectors in the sector to this new material.

You can find more information via http://www.ecobond.com.au.

Contact:
Dr. Khoo Le and Prof. Vivian Tam, Inventors of CO₂ Concrete. E info@ecobond.com.au

Special thanks to our sponsors

We have upscaled our CO₂ Concrete production. With the success of our biosecurity platforms at Hawkesbury Farm, Western Sydney University, we made four 3m x 3m concrete slabs with our CO₂ Concrete. The slabs were cast in March 2019 using our 2 innovative mix designs. The slabs are employed to support gross animal weight (about 1 ton each) for their troughs (drinking stations).

We are looking for Investors, Partners and Network connectors in the sector to publicise this new material.

You can find more information via http://www.ecobond.com.au.

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Contact:
Prof. Vivian Tam and A/Prof. Khoa Le, Inventors of CO₂ Concrete, Ecobond Pty. Ltd., info@ecobond.com.au

Special thanks to our sponsors
Green Industries SA and Innovyz Institute are investing in the rapid commercialisation of innovative ideas.
Professor Vivian WY Tam

vivian@ecobond.com.au

www.ecobond.com.au
Professor Vivian WY Tam
Associate Dean (International)
School of Computing, Engineering and Mathematics
v.tam@westernsydney.edu.au