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Factor 5 in eco-cement: Zeobond Pty Ltd

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Cement production is estimated to be responsible for approximately 6 per cent of total global greenhouse gas emissions. One of the most promising alternatives to common Portland cement is geopolymer cement, and Australian company Zeobond is a bone fide leader in its manufacture.

Credit: AP/Zeobond

Geopolymers are formed by reaction of an aluminosilicate powder with an alkaline silicate solution and require no special curing. Even better, they can be manufactured from industrial waste stock, like the vast amounts of fly ash that are produced from coal combustion. If these waste streams reduce over time, geopolymers can be made from very commonly available materials, such as clays.

In 2007 the IPCC called for greenhouse gas emissions to be reduced across all sectors by a factor of five (80 per cent) by 2050. CSIRO has found that, for every tonne of Portland cement manufactured, one tonne of carbon dioxide is produced. Along with University of Melbourne researchers, CSIRO found that geopolymer technology enables a five-fold energy efficiency improvement (Factor 5), thus reducing greenhouse gas emissions by 80 per cent, because high-temperature calcining (ore breakdown) is not needed.[1] Alumina-silicate cement can be used for every major purpose for which Portland cement is currently used, and recent studies of its use in the 1960s and 1970s in buildings in the Ukraine and Russia show that it has better durability.[2]

Credit: Zeobond

Australia is now among the world leaders in research and commercialisation of geopolymer cement. After almost two decades of development, private Melbourne-based company Zeobond Pty Ltd was formed in 2006 by researchers from the University of Melbourne to commercialise geopolymer cement. They created a new product called E-Crete which forms at room temperature, requires no kiln and uses fly ash as the main feedstock.

Zeobond laid the first test slab of E-Crete in 2007 and is now considering production in several countries in South-East Asia and North America. The product looks similar to and performs in the same ways as concrete. It can also be used in most cases where concrete is used today, such as in ready-mix applications including house slabs, foot paths, driveways, and in pre-cast products such as bricks, blocks, pavers and panels.

Life cycle analysis studies show that E-Crete produces 80–90 per cent less carbon dioxide[3] than traditional Portland cements. According to Zeobond Business Manager, Peter Duxson, at current small commercial scale Zeobond can make a range of geopolymer products for only 10 per cent more cost than Portland cement, using existing supply chains.

‘That is like saying someone in a small factory in the western suburbs of Melbourne can make a plug-in hybrid car, and all the parts, and it will only cost just over a couple of thousand more than any car produced by the big global car manufacturers,’ Duxson says.

‘With this excellent starting position, as the scale of commercialisation is increased and more is invested in the supply chains, we expect the costs of making geopolymer cements to come down significantly.’

According to the Massachusetts Institute of Technology, approximately 2.35 billion tons of Portland cement are made each year. If carbon dioxide emissions in the world’s cement manufacturing sector can be reduced by even 10 per cent, that would accomplish one-fifth of the Kyoto Protocol 2012 goal of an average 5.2 per cent reduction in developed country carbon dioxide emissions from 1990 levels.

Zeobond’s early success shows that Australian research and development can punch above its weight in creating potentially world-changing eco-innovations.

More information:

Zeobond Pty Ltd., http://www.zeobond.com
Zeobond will be featured as one of the leading case studies in the forthcoming international publication *Factor 5: Transforming the Global Economy through 80% Improvements in Resource Productivity*, by Weizsacker E, Hargroves K, Smith M, Desha C and Stasinopoulos P (Earthscan, 2009). See http://www.naturaledgeproject.net/factor5.aspx

1 See CSIRO – ‘Geopolymers: building blocks of the future’ at http://www.csiro.au/science/ps19e.html. Accessed 4 September 2007

2 Xu H, Provis JL, van Deventer J and Krivenko PV (2008) Characterization of aged slag concretes. *ACI Materials Journal* March–April 2008.

3 Net Balance Foundation (2007) ‘Zeobond carbon emission life cycle assessment of geopolymer concrete’. Net Balance Foundation.

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