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Fireproof concrete rises from the ashes

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The 13.5 million tonnes of fly ash produced each year by Australasia's coal fired power stations could become a valuable source material for fireproof concretes–and deliver a significant environmental dividend.

Research by William Rickard and colleagues at the Cooperative Research Centre for Sustainable Resource Processing at Curtin University of Technology in Perth has shown that fly ash-based geopolymers exhibit remarkable fire resistance while maintaining a high degree of mechanical strength. He will present the results at the Pathfinders: the Innovators Conference at the National Convention Centre in Canberra this week (May 26–28).

The team has made geopolymers, a cement-like material formed by dissolving materials that contain silicon and aluminium, such as fly ash, in a highly alkaline solution for use in high temperature applications such as fireproofing and building insulation.

Mr Rickard, who has been concentrating on high temperature applications of fly ash geopolymers, said he became interested in the field after reading of their engineering and environmental potential.

"We have found the geopolymers have great fire resistance," he said.

"Because of their amorphous polymeric structure, geopolymers maintain structural stability to much higher temperatures than conventional concrete, in which calcium based phases break down above 600 degrees. In geopolymers, strength is maintained or increased up to 1200 degrees. "

About 46 per cent of the fly ash from power stations–worth some $120 million annually–is re-used, with the greatest part employed as filler for cement.

For example, the award winning concrete Seacliff Bridge between Sydney and Wollongong includes 25 per cent fly ash from the Eraring power station in the NSW Hunter Valley.

As well as using a waste product from burning coal in power stations, and providing a strong construction material designed to insulate against fire, geopolymers also reduce greenhouse gas emissions.

Beyond reducing source material cost and lessening the amount of fly ash being dumped in landfill, making geopolymers produces 80 per cent less greenhouse gases than Portland cement, the cement used in everyday construction.

Cement manufacture contributes 5–8 per cent of the world's greenhouse gases emissions.

Mr Rickard said the use of fly ash geopolymers as a fireproofing material not only provided an inexpensive solution to fire protection but also had a suite of benefits for the environment and community.

He is one of eight early career scientists invited to present their research results at the Cooperative Research Centres Association's Pathfinders Conference. The CRCA represents Australia's 50 CRCs operating under a federal government program to drive public/private sector research.

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