SACAA ASH FLASH ES

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THE MEDIUM (since 2010) FOR QUICK ELECTRONIC COMMUNICATIONS WITH THE MEMBERS OF THE SA COAL ASH ASSOCIATION

Introduction

This edition of AshFlashes deals with a broad range of topics including the availability of a new handbook on coal combustion products, mineralogical data on Roman Concrete and a novel carbon capture technique based on fly ash.

Hope you find these articles enjoyable and informative.

Kind regards

Richard Kruger

WELCOME - WELCOME - WELCOME

The South African Coal Ash Association (SACAA) would like to welcome Andries Phala from AJT Projects and Peter Lubhulo Masanga from Wotungithathe Business Enterprises as new members. They are both new to the ash business and are keen to learn and contribute to the future utilisation of ash in their manufacturing processes.

❖ Carbon Capture and Storage

Carbon capture and storage is a key aspect of clean coal power generation but because costs are high, implementation is not widespread. The recent news that Great River Energy (GRE) is developing novel CO_2 capture technology using fly ash raises expectations for the development of a cost-effective process.

According to the Bismarck Tribune, Expansion Energy LLC, developer of the VCCS Cycle, approached GRE to implement this process to capture flue gas at its Spiritwood Station near Jamestown, North Dakota.
http://bismarcktribune.com/business/local/coal-power-company-to-test-new-uses-for-carbon/article_5d61fcab-1b98-5998-9ce6-93a984537d24.html

The technology involves mixing flue gas with fly ash in a reaction vessel and allowing carbon dioxide and carbon monoxide to be absorbed into the fly ash. The reaction creates calcium carbonate and a methanol vapour. The methanol could be recycled back into the beginning of the VCCS process, while the calcium carbonate would be used within the plant to absorb sulphur dioxide out of the flue gas. Due to the prevailing cold weather in the region, the intention is to inject treated flue gas into an onsite greenhouse.

GRE is seeking funds from North Dakota's Lignite Research Council to undertake the project as well as a project sponsored by North American Coal to inject flue gas into an onsite greenhouse at the Coal Creek Station. Specifically, the funds would allow GRE to use 100 pounds of fly ash in a lab setting to determine the correct ratios for use, and then allow for the full-scale pilot project to begin operations.

Ancillary research would test for rare earth elements in North Dakota coal seams. "We think that (carbon capture research) is the key to unlocking additional efficiencies and revenue possibilities for North Dakota's coal reserves," said Lignite Energy Council President Jason Bohrer.

❖ **Ancient Romans made world's 'most durable' concrete - we might use it to stop rising seas**

By Ben Guarino, 4 July 2017, Washington Post

Drilling at a marine structure in Portus Cosanus, Tuscany, 2003 (JP Oleson)

Two thousand years ago, Roman builder's constructed vast sea walls and harbour piers. The concrete they used outlasted the empire and still holds lessons for modern engineers and scientists.

A bunch of half-sunken structures off the Italian coast might sound less impressive than a gladiatorial colosseum, but underwater, the marvel is in the material. The harbour concrete, a mixture of volcanic ash and quicklime, has withstood the sea for two millennia and counting. What's more, it is stronger than when it was first mixed.

The Roman stuff is "an extraordinarily rich material in terms of scientific possibility," said Philip Brune, a research scientist at DuPont Pioneer, who has studied the **engineering properties** of Roman monuments. "It's the most durable building material in human history, and I say that as an engineer not prone to hyperbole." By contrast, modern concrete exposed to saltwater corrodes within decades.

The mystery has been why the ancient material has endured for so long. "Archaeologists will say they have the recipe," said Marie Jackson, from the University of Utah, an expert in ancient Roman concrete but it's not the complete picture: It's one thing to assemble the ingredients, another to know how to bake the cake.

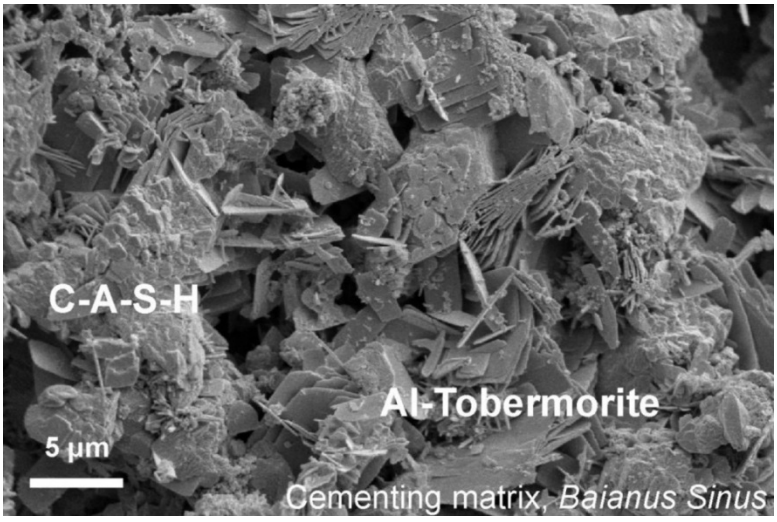
To that end, Jackson and her colleagues peered into the microscopic structures of concrete samples, taken from the sea walls and piers as part of the Roman Maritime Concrete Study.

This rocklike concrete is behaving, in many ways, like volcanic deposits in submarine environments," Jackson said. Where modern concrete is designed to ignore the environment, Roman concrete embraces it. As the scientists report in a study published in the journal ***American Mineralogist,*** Roman concrete is filled with tiny growing crystals. The crystals, like tiny armour plates, may keep the concrete from fracturing.

The scientists subjected the concrete samples to a battery of advanced imaging techniques and spectroscopic tests. The tests revealed a chemical reaction was occurring with aluminous tobermorite (calcium silicate hydrate) crystals growing out of phillipsite (a hydrated potassium, calcium aluminium silicate). This work can be considered a significant accomplishment and has been likened to biting into a cake and determining that the baker used organically sourced dark chocolate.

In this instance, the key ingredient proved to be seawater. As it percolated within the tiny cracks in the Roman concrete, it reacted with the phillipsite naturally found in the volcanic rock to form the tobermorite crystals.

Aluminous tobermorite is very difficult to produce, and requires high temperatures to synthesize small amounts. Learning from the Romans might lead to better production of tobermorite, which is prized for its industrial applications.



Crystals of Al-tobermorite growing within Roman concrete (Marie Jackson)

The Romans mined a specific type of volcanic ash from a quarry in Italy. Jackson is attempting to recreate this durable concrete using seawater and more abundant volcanic rocks. She has several samples sitting in ovens and jars in her lab, to test for evidence of similar chemical reactions.

If her effort is successful, the concrete could yet have a role to play in human history — "if one was indeed interested in making sea walls" and "forced to protect shoreline environments," Jackson said. In one 2014 study, a team of European climate scientists predicted that, if the next 90 years follow the trend of the past 30 years, the cost of constructing barriers to hold back the sea might be as high as $71 billion annually. The alternative, flooding of the coastline, could do trillions of dollars in damage.

Modern sea walls require steel reinforcements. The Romans didn't use steel, their reactive concrete was strong enough on its own.

❖ Publications

With the growing interest in ash utilisation an increasing number of enquiries are being received as to the most up-to-date and relevant handbook. Your editor has found the following, published in 2017 to be comprehensive and most informative:

- Coal Combustion Products (CCP's) Characteristics, Utilisation and Beneficiation. Edited by Tom Robl, Anne Oberlink and Rod Jones. This Woodhead Publication, under the auspices of Elsevier, was compiled by authors from throughout the world (including South Africa), who collaborated in writing the 21 chapters of the book.

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