PROCESS PERFORMANCE
Orebody's DNA unlocked via GeM[III]
Page 3

SOLVENT EXTRACTION
Wrong turn for reagents can prove a costly move
Page 6

PARKER CENTRE
Education program builds industry capacity
Page 10

CSIRO

CSIRO research in minerals processing and metal production JUNE 2010

PROCESS

DRY GRANULATION

Eco-technology one spin closer to industry use

Key points

- A dry slag granulation process has been developed that involves pouring slag onto a spinning disc
- The process produces value-added cement products and recovers waste heat, which no other process has been able to do
- An industrial-scale pilot plant will be designed and built at an Australian blast furnace in the next two to three years

Dr Dongsheng Xie (left) and Bernie Washington inspecting the laboratory scale plant for integrated dry granulation and heat recovery process. PHOTO: MARK FERGUS

By ALEXANDRA ROGINSKI

A NOVEL dry method for slag granulation could be used commercially within two to three years, providing a sustainable solution for treating the hundreds of millions of tonnes of molten slag produced globally each year.

Developed by a team from CSIRO's Minerals Down Under Flagship, and undertaken in part through the Centre for Sustainable Resource Processing, the new process can produce value-added products for cement application while recovering waste heat, which no other process has been able to do.

"Plus, we expect a lower cost and much lower environmental impact," project leader Dr Dongsheng Xie says.

A smelting plant producing one million tonnes of steel per year also generates about 300,000 tonnes of slag. Although some blast furnace operations use the slag material in landfill, others use a water quenching process to produce granules for use in cement.

However, wet granulation consumes a lot of water, generates acid mist that causes air pollution, and does not recover a large amount of the heat. Some 1.8 gigajoules per tonne of slag are lost when it cools from 1500°C to ambient temperature.

Although researchers around the world have attempted to put dry granulation into practice for more than 20 years, there have been major challenges in process design and operation.

For example, the dry method involves pouring slag onto a spinning disc and breaking the slag under centrifugal force to form fine droplets, which are then quenched to form solid granules within seconds.

"If any of the variables are not controlled properly, you can literally tear the slag in the form of glass fibres, causing serious operational issues," Dr Xie says. "You need to design and control the process so that you only form droplets."

Through extensive tests and process analysis, the CSIRO team developed a disc and process that has been successfully demonstrated using a prototype rig of 1.4 metres in diameter at a tapping rate of up to 10 kilograms per minute. Researchers used industrial blast furnace slags provided by industry partners.

The resulting slag products have been shown to have a very high glass content with properties suitable for cement application. An evaluation of financial benefits from the technology has also

CONTINUED PAGE 2

Inside

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Process

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COMMENT

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Building capability for industry impact

Having a sound capability base is essential for developing technological advances for the minerals sector. It is for exactly this reason that CSIRO can play its part in securing a vibrant future for Australia's minerals industry.

Our capability base is more than the science and technology required to develop and improve mineral processes; it is also our people, their skills, their equipment and the support infrastructure.

Using our in-depth understanding of science and technology we can research real-life processes to improve and streamline them. This can be done quickly and efficiently as we work from a fundamental and innovative knowledge base.

The relationship between industry-based research and capability-building is a two-way process. By working on real, specific problems for customers, we build our knowledge base and can apply it to a variety of operations and process variations.

The solvent extraction feature story (see pages 6 to 8) provides a powerful illustration of how CSIRO applies its fundamental understanding of solvent extraction to sponsors' sites, which in turn further builds our capabilities in this area.

But it is not just through industry-based research that we build our capabilities. CSIRO itself also invests significant time, money and effort in strengthening the science capability base of the future.

CSIRO's Office of the Chief Executive (OCE) provides generous funding for well-articulated and innovative capability development initiatives. In Open Space (see page 11) one of our Science Leaders, Dr Miao Chen, provides a powerful example of how her OCE-subsidised research will bring rewards well beyond the benefits in developing bioleaching.

I hope that you will read this issue of *Process* with interest and that it will show you our wide range of activities for the industry all stem from a common, in depth understanding of our science and technology. It is this ability to draw from a strong capability base that enables us to continue to have an impact across a wide range of industry projects.

Eco-technology one spin closer to industry use

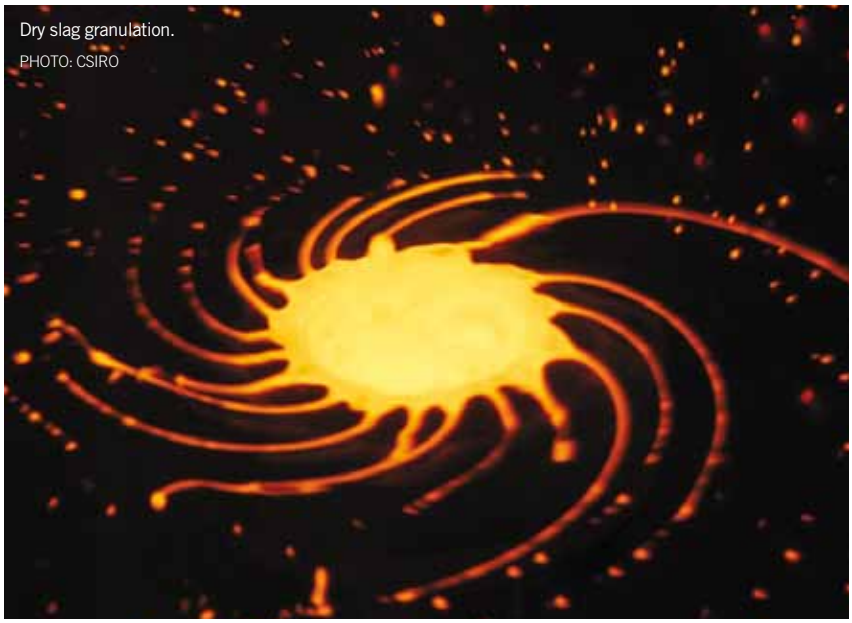
FROM PAGE 1

shown encouraging results.

Work is now almost complete on a semi-industrial plant for further demonstration and for validating the computational fluid dynamics model developed.

Based at CSIRO's Clayton site, the semi-industrial rig should be commissioned soon. If all goes well, an industrial-scale pilot plant will be designed and built for plant trials at one of the Australian blast furnaces in the next two to three years.

The work is co-sponsored by OneSteel and BlueScope Steel and has attracted strong global interest from slag producers, cement producers and some leading international engineering companies.



Dry slag granulation.
PHOTO: CSIRO

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