

Comminution

Cutting comminution costs

Declining metal prices have brought a renewed focus by member companies on improved production efficiency. AMIRA Project P1003, "Energy Efficient Grinding and Liberation," will enhance practical application of the industry's expanding knowledge of the complex relationship between mill type, grinding media and final grind size on cost-efficient recovery.

It has two interdependent components:

1. Application of stirred milling to mainstream grinding for rougher recovery
2. Application of stirred milling to regrinding for cleaner circuits.

The project leader will be Associate Professor B. Klein of the University of British Columbia assisted by Assist Prof M. Pawlik. They will have additional input from McGill University's Assoc Prof P. Radziszewski and Research Fellow Jan Nessett and from Associate Professor S. Grano of the Ian Wark Research Institute, University of South Australia. Collectively this group brings unsurpassed expertise in the relationship between mill technology and flotation advances. Coordination is by AMIRA's Research Director, North America, Terry Braden.

It is proposed the three year project be supported by

- Three site sponsors, each at US\$120,000 a year.
- Six knowledge sponsors, each at US\$80,000 a year.
- Two supplier sponsors each at US\$40,000 a year.

With ARC/NSERC support and cash and in-kind industry contributions this provides a budget of US\$1.5 million a year. This equates to a leverage on funds outlayed of 12:1 for site sponsors (who gain specific own-site results) and 15:1 for knowledge sponsors. Technology transfer mechanisms include provision for sponsors to have on-site workshops.

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Efficient microwave liberation a step closer



The photograph shows project Sponsors, Researchers and AMIRA P879A Research Director, Richard Beck in front of the new equipment

Use of microwaves to assist in the liberation of minerals has taken a large step forward with the commissioning of specialised microwave equipment developed by e2v technologies at Chelmsford, England. This is the result of AMIRA project P879A "Microwave Assisted Comminution and Liberation of Minerals".

Earlier stages of this project showed that the operating conditions required for economic application of microwaves for improved liberation required equipment that operates in ranges that did not exist. e2v technologies over the last 18 months has designed and built such equipment. Test work to prove the reliability of the equipment is ongoing, while the researchers from Nottingham and Stellenbosch Universities carry out test work to validate the liberation models that have been developed from lower power continuous microwave equipment.

e2v technologies is one of the leading manufacturers of high technology electronic components and subsystems. They supply to niche sectors of the medical, science, aerospace and defence industries.

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Latin America expansion for P9O

Professor Marcelo Tavares from the Universidade Federal do Rio de Janeiro (UFRJ), Brazil, has joined the research team of Project P9O to develop the ball mill model.



This addition to the team has been made possible by additional funding from project sponsor, Vale who wished to develop expertise at a Brazilian University. Prof Tavares has established an international reputation in the field of modelling, has published extensively on the fundamentals of breakage and has recently presented a new and more mechanistic model of batch ball milling.

Dr Walter Valery of Metso, one of the P9O sponsors, set up a meeting with Professor Malcolm Powell of the JKMRC (who leads the comminution side of P9O) and Prof Tavares at the Comminution '08 conference in the UK and thus facilitated the incorporation of Marcelo onto the team.

Prof Powell said he is excited by the addition of Marcelo and his modelling expertise to the team. His recent work with graduate student Rodrigo Carvalho on the ball mill model is an ideal fit to the project objectives, and he has been slotted in as the project leader on the ball mill model development.

This model development now spans the globe, with researchers from four continents (South America, Africa, Europe, and Australia) working in close collaboration on various aspects of the model.

This is the first time a South American research Institute joins the P9 project, and this opens up exciting possibilities of strengthening the project and sponsor base in this mineral rich continent. UFRJ joins the JKMRC, UCT, University of Newcastle, McGill and Hacettepe as researcher providers for P9O.

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Mining

Underground 3-D imaging improves planning and efficiency

Sirovision, the commercialised three dimensional imaging system developed from CSIRO research, is becoming an increasingly used tool. New advances that enjoyed support from AMIRA project P788 are allowing its use to be extended from open pit to underground.

Commercialised by Datamine, Sirovision combines advanced digital photography with sophisticated computation to produce a 3D image that provides extensive geotechnical and geological information. It can markedly increase the speed with which geologists and engineers provide instructions to production crews about ore/waste delineation, make better decisions about safety and improve mine and blast designs.

The underground application of the technology flows from a 2006 joint integration project between Datamine (project managers), AngloGold Ashanti (sponsors), CSIRO and Century Systems (development partner for Geological Database Management Systems). The pilot project for an underground system was successfully completed in January 2008.

Other companies now using Sirovision include:

- Xstrata Nickel UGIS (underground in-cycle imaging) -- trial completed April 2008; implementation Q1 2009
- Vale Voisey's Bay open pit – implementation, October 2008
- African Copper Mowana -- implementation October 2008
- AngloGold Ashanti Siguri -- Implementation November 2008
- AngloGold Ashanti Moab Khotsong – Operational Testing Q1 2009

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Processing

Improved treatment for high-sulphur residues

There is increasing industry interest in technologies to treat sulphur-rich residues from hydrometallurgical processes – with the aim of not only improving sustainable storage but also capturing sulphur, precious metals and other by-products.

Such residues result from hydrometallurgical processes commonly used in the production of copper, zinc and nickel. Typically they contain elemental sulphur, gypsum (from lime neutralisation), iron oxides, acid insoluble concentrate components, minor base metals and precious metals.

These residues currently require long-term storage. Because residue with a high elemental sulphur content is flammable, sub-aqueous storage in a low dissolved-oxygen environment has been one option, but a number of environmental bodies have questioned the long term desirability of this, arguing that the material is not inert.

Vale has expressed interest in a research program to explore improved treatment processes which would address both these sustainability issues and recovery of by-products. Because of the widespread use of these hydrometallurgical processes, there would appear to be benefits in other companies joining the project.

Canadian and other North American researchers would play a key role, with Memorial University, Newfoundland, keen to be involved.

This is an issue for a wide range of nickel, copper and zinc producers. Further information is available from Terry Braden, Regional Manager of AMIRA North America.

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Geoscience

African copper deposits under the spotlight

Understanding of the famous Central African Copper Belt has been significantly enhanced by a conference and regional visit conducted as part of the final sponsors review meeting of AMIRA project P872.



“Green Wall” at Fungurume

The meeting at Lubumbashi and visits to five major copper deposits in the Democratic Republic of Congo and Zambia involved over 100 geoscientists from exploration and producing companies, academic researchers and the DRC-owned Gecamines. The deposits visited included Tenke-Fungurume, Kolwezi, Lumwana, Lupoto and Kinsevere.

Field trip attendees at the famous

While the most effective immediate advance in understanding flowed from piecing together the extensive but often fragmented knowledge held by members of this diverse group, a longer term gain is the more permanent communication links created. Visits to such developing regions often have a bonding effect on participants and continuing information exchanges are likely to produce a more comprehensive understanding of this poorly known mineral rich region.

Participating companies included Anglo American, Anvil, BHP Billiton, Equinox, First Quantum, Freeport, Forrest, Gecamines, Katanga Mining, Rio Tinto, Teal and Vale with a number of these companies sending extensive teams.

Researchers included Murray Hitzman of the Colorado School of Mines and David Selley, Stuart Bull, Robert Scott, Peter McGoldrick, Lyudmyla Koziy, Mark Duffett and Jacqueline Halpin from CODES at the University of Tasmania.

The tour was organised and coordinated by Alan Goode of AMIRA with the very generous assistance of locally based sponsor companies in DRC and Zambia.



Field visit to the Kwatebale Ecaille

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