3:45 PM

Use of Fiber Optic Systems for Distributed Monitoring of Rock Mass Strain, Temperature, and Vibrations: an Underground Case Study

M. MacLaughlin[1], C. Kammerer[1], M. Speece[2] and N. Nesladek[2]; [1]Geological Engineering, Montana Tech, Butte, MT and [2]Geophysical Engineering, Montana Tech, Butte, MT

Rock mass strain, mine seismicity, and temperature were measured using fiber optic technology at Montana Tech's Underground Mining Education Center. This research demonstrates the effectiveness of new fiber-optic-based distributed strain and temperature (DST) and distributed acoustic sensing (DAS) technologies under various mining conditions, facilitating their use in the mining industry and contributing to mine safety. The objectives are to demonstrate that these technologies can be employed in an underground mine, to reliably and accurately detect ground deformation of different characters, fluctuating temperature profiles, and vibrations when deployed along rock surfaces, in boreholes, and submerged in water. Sensing cables were installed in two 30m boreholes, around a large pillar, and along the surfaces of the drifts in various orientations. The sensing cables were attached to the rock with either grout or epoxy. Seismic events monitored by the DAS were compared to geophones also installed at the site. Sensing cables were submerged in two flooded shafts (one to a depth of 500m) to monitor changes in water temperature. Additional tests at two active mines will also be reported.

3:45 PM

Improving Tank House Current Efficiency and Sulfuric Acid Leaks Identification Using Drone Mounted Thermographic Camera- Process Safety

F. Dakubo; Hydrometallurgy, Ray Mine, Kearny, AZ

There are several things that affect Tank house current efficiency; includes short circuits, concentration of iron in the electrolyte, specific flow, poor contact from bent anode or cathode contact bars with the triangle bars and leaks. Amp clamps and hand-held infrared camera have been used to identifying shorts in Tank house. However, these methods are tedious and sometimes unsafe. Example, using amp clamps usually exposes one to the current in the buss bars. This study looks at shorts identification using drone mounted thermographic (IR) camera. We will also demonstrate the use of the drone IR camera in identifying sulfuric acid in difficult to reach areas.

3:45 PM

Sharing Learnings Through Social Media

B. Ross; Lowell Institute for Mineral Resources, University of Arizona, Tucson, AZ

The way that many people communicate and the sources they use have changed significantly the past several years. Instead of books, trade magazines, conferences, and courses to share knowledge and ideas many people rely on the internet and particularly social media to be their primary source of information. This paper discusses the use of LinkedIn as an outlet to share information such as critical safety and health controls or leadership to an international audience quickly and effectively. This method has a tremendous advantage in its ability to reach an audience that in many cases would have been out of reach to other communication methods. However social media also has disadvantages in there is less control on the accuracy of the content or the ability to easily retrieve an article when doing a search for research purposes. In addition to the pros and cons, this article will discuss methods to make your LinkedIn article more effective from an author that has written a book and several popular mining related LinkedIn articles on sharing health and safety critical control measures and leadership learned from the massive Manefay landslide at Bingham Canyon.

TUESDAY, FEBRUARY 27

MORNING

9:00 AM | ROOM 200ABC

6th North American Iron Ore Symposium: Agglomeration & Pelletizing

Chairs: *M. Garant, Corem, Québec, QC, Canada*
R. Kiesel, UMD-Natural Resources Research Institute, Hibbing, MN

9:00 AM

Introduction

9:05 AM

New Binders for Iron Ore Pelletization: Step Change for a Sustainable Future

J. Halt and S. Kawatra; Chemical Engineering, Michigan Tech University, Houghton, MI

Iron ore beneficiation needs advances in process control, automation, more efficient burners and furnace designs, new silica-free binders, and even alternative iron-making routes. Some, like new binders, are only step-changes towards a more sustainable future; however, they are important tools for the iron maker's tool box. This presentation will show new binders designed with the hypothesis that thickening and filtration - which precede pelletization and are designed to agglomerate fines and produce flocs for rapid water removal - are bad for pelletization. Under coagulating or flocculating conditions, pellets are rough, weak after drying and organics are combusted (35 N dry, 32 N at 500 °C), and they abrade easily (4.7 g/kg-min at 1100 °C, 0.8 g/kg-min at 1250 °C). However, under dispersive conditions (ie the new binders), pellets are smooth, strong after drying and after organics are combusted (78 N dry, 65 N at 500 °C), and abrasion resistant (2.6 g/kg-min at 1100 °C, 0.43 g/kg-min at 1250 °C). The presentation will show why that is and why the new binders work. It will also compare the new binder to the traditional binder, bentonite.

9:25 AM

BASF Novel Iron Ore Binder Technology: Study of Bentonite Modification

A. Villanueva[1], S. Hoff[2] and A. Michailovski[1]; [1]Mining Solutions, BASF SE, Ludwigshafen, Rhineland Palatinate, Germany and [2]Mining Solutions, BASF Corporation, Silver Bay, MN

In this study, we compare the influence of two water soluble polymer-based organic binders added to bentonite, to form a hybrid-binder system for Iron Ore Pelletization. The kinetics of the agglomeration process and resulting properties of green pellets were analyzed, and examined in detail through Scanning Electron Microscopy (SEM) and Confocal Laser Scanning Microscopy (CLSM) analytical techniques. It was encountered that the differences in the mechanical properties of the pellets produced by each binder system could potentially be explained by the ability of the polymer to interact with bentonite at a macromolecular level.

9:45 AM

Mustang Pellets – From Pot Grate Tests to Production

P. Carlson; Cliffs Technology Group, Cliffs Natural Resources, Ishpeming, MI

Cliffs has been providing high quality iron ore to their steel customers for over 170 years. The Mustang pellet currently being produced at United Taconite is no exception. The Mustang pellet was tailor-made to replace the Viceroy pellet from the Empire Mine in Michigan. Developing a customized

TECHNICAL SESSIONS

MONDAY, FEBRUARY 26
AFTERNOON

1:30 PM | ROOM L100A

Dreyer Lecture

Recipient and Lecturer: *Robert Schafer*

Lecture: TBD

MONDAY, FEBRUARY 26
AFTERNOON

2:00 PM | ROOM 200ABC

6th North American Iron Ore Symposium: Mining & New Projects

Chairs: *G. Hudak, University of Minnesota*
D. Gagnon, DRA Americas

2:00 PM
Introduction

2:05 PM
Advantages of Using UAVs in Pueblo Viejo
J. Ozoria; Mining, Dominican College Of Engineers, Architects and Surveyors (CODIA), Santo Domingo, Santo Domingo, Dominican Republic

The time in projects of any kind has always been a fundamental issue from the start of construction to the operation itself, when it comes to earthworks on a large scale such as an open-pit mining operation; it is when we realize how valuable it's the time. The main objective of this presentation is to expose the advantages that make the UAV technology in mining a valuable and important tool for the management of geospatial information more efficiently and the control of the different material types in a mine with space limitation asPV. it will show the benefits of managing a mining operation with UAV. Substantial improvements in Pueblo Viejo from the area of safety, efficiency, quality and planning once implementation began. Today in Pueblo Viejo there are many applications that are carried out day by day with the use of UAVs. From the end of month report, stockpile inventory, construction monitoring, mine plans, slope monitoring, blast analysis, chess reporting. Undoubtedly, the UAVs in Pueblo Viejo came to stay, since the limitation of space and having different material types being dumped on top or beside each other. With the incorrect tracking the control of grades will be lost.

2:25 PM
An Evaluation of Rock Weathering Experiments at the MN DNR Hibbing Laboratory and Field Research Site and Their Importancein Developing Geochemical Models
S. Koski and Z. Wenz; Minnesota Department of Natural Resources, Hibbing, MN

Since the mid 1970's, a focus of the DNR Hibbing laboratory and field research site has been the development and evaluation of the humidity cell kinetic test procedure and field scale rock weathering experiments. These experiments have allowed for the assessment of the relationship between sulfur concentrations, leachate pH and solute release rates for varying rock types and mine wastes along with the ability to understand rock weathering geochemistry over decades of monitoring. In 2014 an experiment was initiated to develop a laboratory rock weathering procedure that would allow leachate solute concentrations to become limited by mineral saturation and sorption. The experiment consisted of standard humidity cells, a variant of the humidity cell, and 4 kg rock filled columns. The different experiment methods using the same two rock types have shown that similar rock types may generate different leachate compositions when following different experiment protocols. This can provide insight into geochemical processes occurring in these experiments and may allow for more accurate representations of full scale mine waste weathering and data to be used in geochemical modeling.

2:45 PM
Automation Application Realities for North American Iron Ore Laboratories
B. McBain; IMP Automation Canada Ltd., Oakville, ON, Canada

Extensive experience has been gained in the mechanization and automation of iron ore laboratories since the mid-2000s, when the first series of IMP automated labs gained a foothold in the Australian mining sector. Because of the large scale operations that often handled sample streams from several mines, these labs feature front-to-back automation that manage several hundred to a few thousand samples per day. In addition, a stringent focus on safety and regulatory compliance resulted in design strategies to limit worker access and ergonomically-challenging demands. IMP's first North American iron ore lab opened in 2014 at the TATA Steel Mineral Canada site near Schefferville, Quebec, but for various reasons this lab is a hybrid of manual and pseudo-automated processes. For the North American market, there are automation considerations to be made on the basis of lessons learned in both Australian and Canadian labs. This presentation will review the practical importance of such factors as mine output and ore type, labour factors, safety requirements and specialty iron production. It will also discuss some of the aspects to be considered in port laboratory specifications.

3:05 PM
Dominga Iron Project Update – Andes Iron
M. Rojas[1], H. Alegria[1], F. Porcile[1], M. Mlinar[2] and B. Eisenbraun[3]; [1]Dominga Project, Andes Iron, Saniago, Las Condes, Chile; [2]Coleraine Labratories, Natural Resources Research Institute, Coleraine, MN and [3]Barr Engineering Company, Hibbing, MN

A Chilean mining company Andes Iron SpA owns and is developing the Dominga Mine and associated port project. This is a greenfield project located in La Higuera, some 70km from La Serena in Chile's Coquimbo region. Andes Iron SpA, founded in 2011, acquired the Dominga project from its former owner, Minería Activa. The mine design will be consist of two open pits and include a processing facility for the extraction and beneficiation of magnetic iron ore, with copper as a byproduct. The Dominga project is expected to have a 26-year project life span. The initial investment is expected at $2.5