Stress Monitoring in Potash Mines

Stresses in mines can be a significant factor influencing stability conditions, especially in underground pillars. Current stress measuring techniques in potash are based on measurements of the strain response to stress, coupled with an estimate of the elastic modulus of the potash. There are major challenges with the interpretation of existing methods of estimating stress conditions in potash mines. This project investigated current approaches for measuring stress change, includes lab testing on two common approaches and recommends a new methodology for applying two instruments to assess both stress and modulus change in potash.

The researchers at the University of Saskatchewan used two in-situ techniques for this research, vibrating wire stress-meter and the borehole hollow inclusion cell. The vibrating wire stress-meter is used as a method for long-term stress change monitoring which was no dependant on an accurate modulus for the rock mass. The hollow inclusion stress cell was designed for measurement of the in-situ stress state, but the researchers here used it for stress change monitoring which has been shown that similar devices are successful in short-term situations.

The researchers conducted five laboratory tests with a range of loading rates, including one creep test. In theory a higher loading rate should result in a stiffer potash response, this in turn should result in a higher sensitivity factor. The repeatability of the experiment shows the vibrating wire cell is capable of consistent measurements in potash. The researchers proposed two cell convergence method demonstrates an approach for obtaining estimates of both stress change and effective rock modulus, but with the calibration chart being used, the method cannot provide reasonable results with the data.

From the creep test, the observation that creep behaviour influences the vibrating wire readouts provides further justification of this research. By extension of the two-cell convergence method, the two instrument types will also respond differently to creep. The test presented a relaxation of wire tension and vertical expansion of the hole. While this expansion is happening, the overall sample exhibited contracting axial strain. This means that in-situ, the difference between a constant load (creep) case, an increasing load case, and a decreasing load case, can be identified.

Proponent: University of Saskatchewan
Project Duration: October 2020 to March 2021
Project Cost $25,000
IMII: $25,000

International Minerals Innovation Institute

IMII is a unique innovation supporting network of mining companies, government departments and agencies, and post-secondary and research institutions, jointly funded by industry and government. It exists to deliver innovations that matter to mining in Saskatchewan.
www.imii.ca