

# **STATE-OF-THE-ART EXPLOSIVE VOD MEASUREMENT SYSTEM**

W.A. Crosby, Ph.D., P.Eng., President  
A.W. Bauer, M.Sc., P.Eng., General Manager  
J.P.F. Warkentin, Project Technologist  
Mining Resource Engineering Limited  
Kingston, Ontario, Canada

## **ABSTRACT**

Recently, significant improvements have been made in both blast design methods and blasting accessories. The introduction of extremely accurate blast delays now allows proper implementation of advanced blast designs. Thus the onus for future blasting improvements has moved from blast design to the need for ensuring that explosives quality is of the highest order. One measurement commonly used to assess explosive performance is the velocity of detonation (VOD).

Commercially available VOD measurement methods currently suffer from significant shortfalls. The time domain reflectometry systems lack the sampling rate and memory capacity required for accurate VOD resolution, and have limited multiple hole capabilities which restricts the system's use in large blast patterns. In addition, blastholes must fire in a specific sequence for all data to be obtained. The discrete point VOD measurement systems, which are based on technologies such as fibre optics or resistive targets, lack the detail needed to accurately profile the VOD.

This paper describes and illustrates, with practical examples, a new system suitable for the measurement of both test sample and blasthole VODs. The system is based on the proven ability to determine explosive VODs using the standard resistive wire/probe technique. The novelty of this new system is its ability to conveniently monitor multiple blastholes, independent of firing sequence, and at very high sampling rates. The unit is based on a PC controlled data acquisition process which allows the operator to obtain significant quantities of high quality data directly from a single production blast. The processed data provide the operator with a significant information base for determination of the explosives' quality.

The system is capable of monitoring firing times to greater than 1 msec accuracy and VODs to 1% accuracy. Up to 64 holes can be monitored in a single blast completely independent of the order of blasthole initiation. Data acquisition rates as high as 20 MHz are possible. This translates into one velocity reading for 0.25 mm (0.01 in.) of explosive assuming an explosive VOD of 4,880 m/s (16,000 ft/s). Total recording time can be as high as 1,000 msec. This system is currently being upgraded, which will allow the measurement of the VOD for a (potentially) unlimited number of blastholes in a single blast.