

A LABORATORY STUDY OF EXPLOSIVES MALFUNCTION IN BLASTING

P.D. Katsabanis and A. Ghorbani
Queen's University at Kingston, Canada

ABSTRACT

Explosives malfunction due to shock waves is a serious concern for successful blasting results. Malfunction includes sympathetic detonation and desensitization of explosive charges as well as the modification of firing times of conventional pyrotechnic detonators.

Small diameter emulsions and detonators were tested in a laboratory environment to identify the parameters affecting malfunction. The experiments had a donor-acceptor configuration and the charges were detonated in the same sequence. Continuous velocity of detonation monitoring was used as an indicator of explosives performance and for studying the timing of the initiation of the acceptor charge and/or detonator, while distance and delay interval between the donor and acceptor were modified. Fumes from the detonating charges were analyzed in a number of experiments while a few experiments were conducted in rock confinement. It was found that both distance and delay interval are important as far as desensitization is concerned. At certain separation distances temporary desensitization, followed by temporary recovery was observed. Toxicity of the product gases was affected by desensitization although this effect ranged from negligible to pronounced and was not consistent. In many cases desensitized explosives reacted completely as evidenced by the concentration of the fumes in the blasting chamber. Conventional pyrotechnic delay detonators malfunctioned due to a shock produced by a 40mm diameter emulsion explosive at similar distances as the explosives (below 203 mm). Furthermore the experiments in granite showed that 40 mm diameter charges can malfunction at separation distances below 330 mm. This malfunction ranged from sympathetic detonation to shock desensitization; in most cases it was associated with severe loss of performance.