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Investigations into the mechanisms of rock support provided by sprayed liners

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ABSTRACT

An investigation into the mechanisms of rock support provided by sprayed liners was carried out practically at three different mines, namely, South Deep Mine (Gold Fields), Mponeng Mine (Anglo Gold Ashanti) and Impala Platinum Mine (IMPLATS). The monitored sites included tunnels and pillars supported by steel fibre reinforced shotcrete and plain shotcrete.

Underground monitoring provided information on the behaviour of shotcrete over time as the pillars and tunnels responded to mining induced stress changes. The exercise played a role in the identification of the possible failure modes of shotcrete in-situ. Underground in-situ bond strength tests were carried out to give an idea of the shotcrete-rock interface bond strength. The monitoring methods included measurement of strains and displacements of the tunnel walls and pillar walls with the aid of Vibrating Wire Strain Gauges (VWSG), Multi-Point Borehole Extensometers (MPBX), Single-Point Borehole Extensometers (SPBX) and laser targets. Inspection boreholes were drilled, and monitored using camera probes to observe the condition of the rock behind the shotcrete. Also, photographs were taken to give an idea of the failure modes and support mechanisms provided to the rock by shotcrete based on field observations.

Fibre reinforced shotcrete laboratory tests were carried out according to the EFNARC and ASTM standards for shotcrete panel and beam testing. The laboratory tests helped in identifying the effects of fibre incorporation into the shotcrete for the support of underground mining excavations.

The results obtained from the field monitoring exercise, field tests, and laboratory tests were used to analyse and deduce the possible mechanisms of rock support provided by sprayed liners in mining excavations.