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The properties and performance of selected thin spray on liners for rock support

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Abstract

Thin spray-on liners (TSLs) are a type of surface rock support used in underground excavations, for maintaining stability at the excavation boundary. Different products are emerging in the market, while little is known about the mechanisms by which the liners support the excavation. There are no generally accepted tests which determine the performance of TSLs for rock support. In the research described in this dissertation, an attempt has been made to investigate the mechanisms of behavior of TSLs for rock support through laboratory tests. Brazilian indirect tensile strength tests, material compression tests, 3-point bending tests and physical model tests were carried out to investigate the performance and the characteristics of the liners for rock support. The Brazilian and the 3-point bending tests are new tests as far as TSL evaluation is concerned. The reviews of literature indicate that no similar testing appears to have been done previously.

The laboratory test results of samples coated with TSL material showed that the sprayed liners enhance the strength of the rock. The load at which failure occurred increased for coated hard rock samples and the mechanism of behavior depends on the type of liner and curing time. The test methods showed that the performance of the TSLs depend on the type of the rock and the quality of the liner. The results for the 3-point bend test revealed that the application of a weak liner to weak porous rocks such as sandstone does not enhance the strength, but further weakens the rock. An explanation is that the moisture contained in the TSL is deleterious to the already delicate sandstone rocks. Such behavior in practice could compromise the safety of the workers in the period shortly after application.

The laboratory test methods showed different mechanisms of behavior of the liners, but all reflected the similar qualities of the liners. The physical model was used to validate the mechanisms that were shown by the specific test methods which are responsible for rock support. The model revealed all the mechanisms of behavior of the TSLs that were displayed by Brazilian, compression and the bending tests. Results of the model tests showed that stability of the excavation and performance of the liner depends on the

orientation of the jointing. The test methods provided invaluable information for comparing the properties and support mechanisms provided by the TSLs.

The research carried out has contributed new knowledge in the “new” field of TSLs.