A Narrow Wall System to Capture Temperature-Stress-Strain Behavior in Paste Backfill

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Abstract:	Placing mine tailings back underground, into mined-out stopes, is becoming increasingly used internationally, providing as it does improve ore recovery, reduced dilution of valuable ore and environmental benefits due to reduced size of surface tailings storage facilities. In recent years a number of stopes backfilled with cemented paste backfill have been instrumented with load cells and piezometers, to improve our understanding of in-situ behavior. Many of these studies have reported results that show increases in measured total stresses when there is no increase in applied load, i.e. even when the backfilling process is long completed. One explanation is that these stress increases result from expansive volume changes of the backfill as it hydrates and generates heat. This paper describes a laboratory apparatus developed to investigate this hypothesis, focusing on modeling narrow stopes as these are relatively common in backfill applications. Results from the experiments agree qualitatively with the reported field observations, showing clear increases in measured wall pressure during periods of temperature increase. The results are important for current and future backfill operations, as it confirms the measured stress increases are realistic and believable, and do not represent a malfunction of the instrumentation, as has previously been speculated.

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ABSTRACT

Placing mine tailings back underground, into mined-out stopes, is becoming increasingly used internationally, providing as it does improve ore recovery, reduced dilution of valuable ore and environmental benefits due to reduced size of surface tailings storage facilities. In recent years a number of stopes backfilled with cemented paste backfill have been instrumented with load cells and piezometers, to improve our understanding of in-situ behavior. Many of these studies have reported results that show increases in measured total stresses when there is no increase in applied load, i.e. even when the backfilling process is long completed. One explanation is that these stress increases result from expansive volume changes of the backfill as it hydrates and generates heat. This paper describes a laboratory apparatus developed to investigate this hypothesis, focusing on modeling narrow stopes as these are relatively common in backfill applications. Results from the experiments agree qualitatively with the reported field observations, showing clear increases in measured wall pressure during periods of temperature increase. The results are important for current and future backfill operations, as it confirms the measured stress increases are realistic and believable, and do not represent a malfunction of the instrumentation, as has previously been speculated.

Keywords: paste backfill, narrow wall, stress strain behavior, temperature, arching

INTRODUCTION

Stress distribution analysis of granular fill material confined within a narrow space between two walls has drawn attention of Landry et al. (2004). Such analyses are not only applicable to granular materials but have also been used to explain the geotechnical mechanisms within paste backfill in underground mine stopes (Belem and Benzaazoua 2007).