

A narrow wall system to capture temperature stress–strain behavior in paste backfill

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ABSTRACT

Placing mine tailings back into underground mined-out stopes is becoming increasingly used internationally because it improves ore recovery, reduces dilution of valuable ore, and increases environmental benefits due to the reduced size of the storage facilities of surface tailings. 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 has been long completed. One explanation is that these stress increases result from expansive volume changes of the backfill as it hydrates and generates heat. This article proposes and describes a novel laboratory apparatus called a narrow wall system 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 pressure during periods of temperature increase. The article concludes that the proposed narrow wall system works effectively and has been able to capture the temperature stress–strain behavior of paste backfill. Thus, the temperature effect hypothesis has now been supported by evidence. Using the system, further studies related to geometrical or scale effects are suggested. The results are important for academics and engineers to improve backfill design in mining operations.

KEYWORDS

Arching; Narrow wall; Paste backfill; Stress-strain behavior; Temperature

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