

TDK Title: Rheological investigation of fly ash – lime –mine water mixtures in rotational rheometer for the development of hydraulic backfilling technology

Scientific Problem Solved

The problem solved with the scientific research is stoppage of the acid rock drainage (ARD) seepage from the abandoned sulphide mine. The determined properties of the fly-ash, lime, and mine water (FLM) mixture were critical in designing the backfilling technology. Correct mixture ratio was critical as it provided the datum upon which the mixing of the different materials would be done to ensure that slurry attain the correct and desired properties to enable its usage as the backfilling material.

Methods applied

In performing the task, a rotational rheometer, was used to determine the rheological properties of a mixture of fly ash, lime, and mine water. This equipment measured both shear rate and shear stress. The results were then curve-fitted to aid in the interpretation of the results and make informed decision.

Tests made

Fly-ash materials of different ages were sampled ranging from 30 days to 4 years. The sampled fly-ash were mixed using an appropriate ratio together with the mine water and lime.

Results

Due to the experimental rheological properties, the filling slurry's thixotropy, yield stress, and plastic viscosity were significantly altered, indicating that an increase in the amount of fly ash had a significant effect on these properties. Additionally, the FLM mixture's rheological properties were identical to those predicted by the Bingham model. The performance of the slurry developed as a result of increasing the concentration of fly-ash. The nearly identical trend of the generated curves indicates that the age of the fly-ash has no bearing on its utilization in backfilling technology.