Rheology, Slurry and Bulk Solids Handling

Consultancy and Training from BHR Group

Consultancy

BHR Group offers independent, confidential consultancy, which supports clients' in-house capabilities for carrying out a wide range of slurry or wet bulk solids projects from system design and instrumentation, through on-line measurement and troubleshooting, to experimental research.

With over 60 years of extensive experience backed-up with a range of rheological testing facilities, many organisations have benefited from our specialist knowledge of non-Newtonian rheology and its application to process engineering.

Typical Examples

- Pipeline design for non-settling and settling slurries
- Open channel flow of Newtonian and non-Newtonian slurries
- Selection and sizing of pumps
- Selection of instrumentation for on-line measurement of slurry properties (flow, concentration, density, viscosity)
- Viscosity/flow curve measurement of non-Newtonian materials
- Mixer selection and storage tank design
- Troubleshooting of the operation of existing plant
- Design of complete systems to handle wet solids systems

Training

BHR Group offers a variety of courses concerning slurry and wet solids handling, and related topics such as rheology and mixing. These courses are delivered both as open events and in-house, tailored courses coupled with consultancy. There are around 100 individual lectures available which can be combined in any way to provide an in-house course and consultancy to meet your training and problem-solving needs.

Open courses offered include:

- Slurry Handling
- On-line Slurry Instrumentation
- Wet and Dry Bulk Solids Handling
- Slurry Viscosity: Measurement and Applications
- Fundamentals of Rheology and its Measurement
- Applying Rheology to Process Design
- Suspension and Paste Rheology
- Improving Mixing Processes for Industrial Applications

Case Studies in Rheology, Slurry and Bulk Solids Handling

Chalk Slurry Transport 92-km Kensworth - Rugby Pipeline

Chalk slurry at 36% by weight moisture is pumped through a 92 km pipeline from a chalk quarry to a cement works in the UK. Following modifications to the slurry make-up plant, there was concern over coarse particle settling in the line. The effect of chalk slurry properties and operational variables on pipe flow conditions had been investigated to optimise chalk slurry transfer through the pipeline. The combined effects of chalk slurry moisture content and options for different pipe diameters on the pump discharge pressure requirement were considered to assess the suitability of a given pipe diameter and moisture content combination. Chalk slurry flow curves were measured at several moisture contents from nominal 36% down to 29% moisture to predict frictional pressure loss for turbulent flow conditions only in the pipeline.

The work showed the minimum moisture content that the chalk slurry could be pumped at, while retaining turbulent flow conditions of interest using the pipe diameter options of interest to the client. It also successfully predicted the pump discharge pressure conditions, so facilitating a comparison with the maximum discharge pressure that the existing pump installation could develop.

Pipeline Flow Thickened Tailings Copper and Gold Mine

The feasibility of a pipeline was assessed to transport thickened tailings from a copper and gold mine to its disposal site. Flow curves of several thickened tailings samples at different solids contents were measured using co-axial cylinder viscometry. Estimates of the frictional pressure gradients were made for all the tailing samples. It was found that the flow was in the turbulent regime for the 68% w/w tailings sample, but in laminar flow for the higher three tailings solids concentrations.

Estimates of pressure losses and the determination of the pipeline flow regime were then used by the client to select and size a pump for the tailings disposal. It also resulted in identifying the sensitivity of the pump discharge pressure requirement to changes in tailings properties.

Pipeline Flow Mica Waste Slurries

The pipeline hydraulics of waste mica slurry discharging from the underflow of a thickener were investigated for a 3-inch ID pipeline, 2050m long, with an overall elevation increase of 80m. For a specified mica solids throughput of 9.53 t/h, the pipe operating velocity was compared with the predicted deposit velocity over a mica slurry concentration from 20% to 50% w/w. Estimates were made of the total differential pressure, as well as the power imparted to the slurry by the pump, and the specific energy consumption (SEC). Two pipe diameters were assumed: 80mm when no mica wall deposit is present, and 70mm when there is a 5mm mica wall deposit.

It was recommended that the pipeline be operated at 23% mica slurry on re-commissioning, provided there is no mica wall deposit, and that the mica concentration be progressively increased to 30% as a wall deposit of up to 5mm in thickness is formed. These recommendations have been used to guide the client in the appropriate operation of the tailings thickener, and to select and size a suitable pump for the thickener discharge.

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