ZINC OXIDE

ZINC OXIDE FROM SECONDARY ZINC (HZS, DROSS)

EQUIPMENT AUTOMATION

BWRNS

INTRODUCTION

This section briefly describes some of the automation technologies that can be included and implemented in the design of a plant to manufacture zinc oxide

While the emphasis is on the processing of HZS, all technologies introduced in this section can be implemented in a plant processing SHG or HG.

BURNS

CONTROLS

- New equipment has much greater flexibility than equipment that was available only a few years ago

- Plant wide DSC systems have become affordable and offer significant operational and marketing advantages.

- A well designed DCS is a requirement for most of the automation systems discussed. Discrete Control options are mentioned elsewhere.

- DCS systems provide level system control features such as auto Q.A. management and scheduling

BURNS

RECEIVING

- The design of the receiving area is much simpler for a plant processing HG & SHG zinc.
- The ideas presented in this section would be an interesting addition to a HG or SHG plant but most options would probably fail a rigorous cost, benefit analysis

RECEIVING AREA AUTOMATION

- HZS is received into the plant in a variety of formats and with varying compositions
- It is important to establish exactly how much zinc is present in the HZS, for
  - Inventory control
  - Process planning
- There are a number of devices available to achieve this

XRF & XRD

- XRF & XRD use X-Rays to determine the composition of the received material
- XRF provides a measurement of each elemental constituent of the material
- The XRF machine works on the principal of X-Ray fluorescence.
- Accuracy is ~0.5%.

- X-Ray (XRD) diffraction detects differences in crystal structure. The results are compared against a database of materials to produce an analysis
- As XRD differentiates between Zn metal & ZnO it provides a more accurate analysis of the metallic zinc in the sample

BURNS

XRD Limits

- An XRF machine can sample material composition without preparation
- An XRD machine requires preparation of a sample
- As oxidic zinc residuals collect on the surface of the ingot, getting an accurate estimate of the total oxidic mass is very difficult

BURNS

TAGGING (RFID)

- Each block will have a different composition so it is important to be able to find a block after it has been analysed and placed in storage

- Bar code readers are useful

- RFID (Radio Frequency ID) tagging provides a way to automate the system

- A purchased radio tag is given a unique ID. number

- Passive tags receive energy from the scanner to enable them to retransmit their ID number

- Tags for a ZnO plant should be passive, polarized and certified for metal objects

- Tags are low cost and disposable

BURNS

FEEDSTOCK STORAGE

- Space is required in the receiving area to allow each block to be easily handled by overhead or mobile shop equipment
- The block is tagged and the ID number is uploaded to the server
- The XRF device receives ID information from the server along with a test results template
- The operator tests the block and up loads the test results to the server

- In a completely automated storage system
  - The ID and location coordinates of the block will be logged in to the inventory control system database
  - The operator selects the daily block sequence for processing
  - The automatic system locates each block in sequence, picks it up and places it on the furnace loader
- Expensive and probably tough to justify

BURNS

REMOVING FEED FROM STORAGE

- The tags illustrated on a previous page have a range of 3.5m. GPS data stored with the XRF results, roughly locate the target block

- An automatic overhead crane receives location data for the next tagged block in sequence

- RFID readers located near the grapple confirm the target and the grab location

- The crane grabs the identified block using a hydraulic grapple

- Batch loading is the preferred equipment. Material is loaded into the hopper using a gantry crane or a mobile loader

- The batch loader is positioned at the furnace door and is elevated to discharge the blocks into the furnace. Material is usually discharged by a shaker drive

- Continuous loading system are possible but require space and are expensive. Material is loaded onto an apron conveyor which is indexed in accordance with the furnace loading plan

BURNS

BATCH CONTROL

- Measurement of material mass entering the furnace is relatively easy
- The batch loader and the conveyor style auto loader can be mounted on load cells
- Feedback from the gantry crane is probably the least complicated and therefore the least cost method of tracking mass transfers to the process

BURNS

PROCESSING

- The batch loader previously described can be designed to serve the double purpose of handling the transfer of Swing Furnace precipitate to the squeezer.

- This will be a semi-auto feature as full automation of precipitate removal is probably not a practical option at this time

- It is now possible to semi automate loading the 3 crucible furnace

- The control system tracks the rate at which zinc is evaporated and uses level 2 control techniques to calculate crucible loads

- The Swing Furnace, collection hoods and Launder work together to initiate the zinc transfer under 3 term control

BURNS

PROCESSING

- Auto loading the 2 retort furnace
  - A Laser is used to scan the surface of the well and returns a mm accuracy signal
  - The measured low level is used calculate the mass of zinc to be transferred
  - The launder, tundish and Swing Furnace combination delivers metal under 3 term auto-control

- Each metal transfer requires a feedback signal of the metal mass transferred
- The Swing furnace tundish loadcells provide this scaled measurement
- An inline flow meter is available and is a recommended option as a fail safe
- Transfer control may be manual, automatic or semi-automatic

BURNS

Material processing

MATERIAL HANDLING

- Handling of the various product lines is relatively straight forward, usually by conveyor

- Degrees of automation can only be defined after a cost benefit analysis of the production rates, the number of grades produced, and client requirements.

- The design of these systems is an important FEED engineering deliverable

- Depending on plant size auto loaders and packaging machines are readily available from a number of different suppliers

- Robotic bag stackers may be a useful consideration if a business case can be made

BURNS

MATERIAL HANDLING
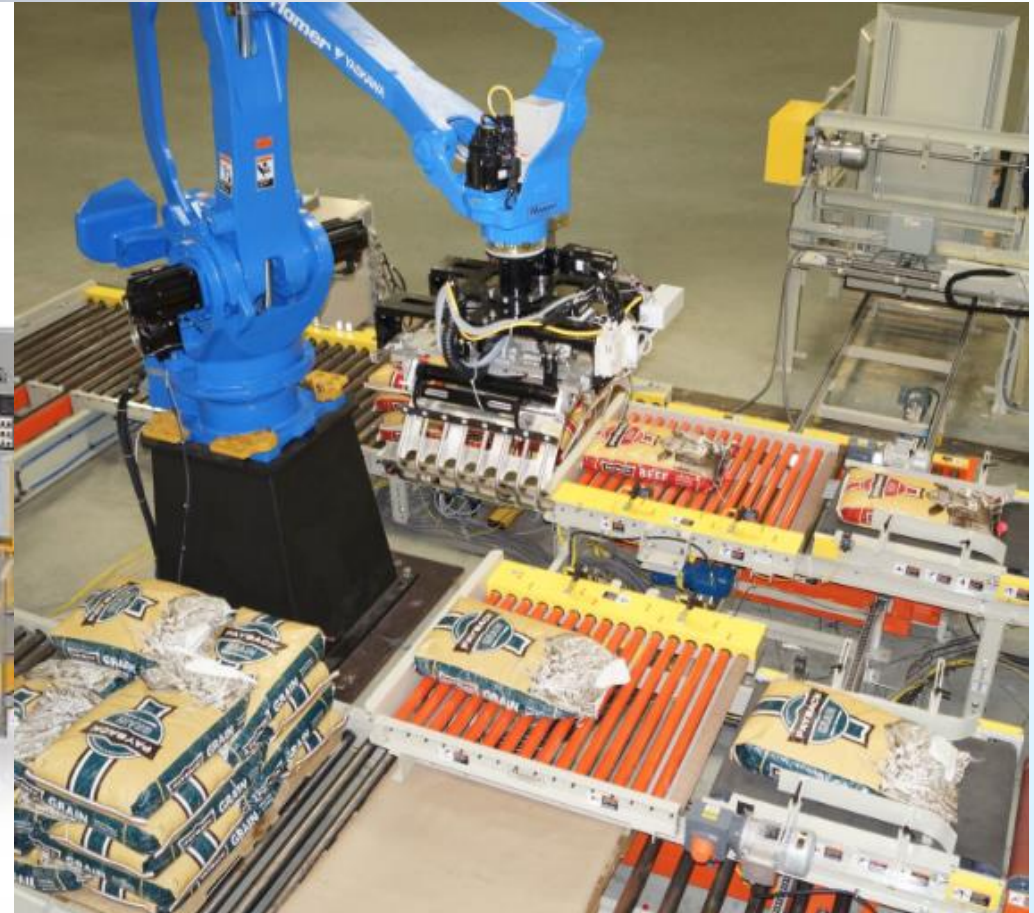
SUMMARY

- Automation can be expensive
- A cost benefit analysis should be prepared for each option and this can only be properly done in an engineering study
- Progressive implementation can be considered
- It is much more costly to add automation features to a project that is already in production

- To provide the greatest benefit, automation measures are best implemented with a plant wide DCS
- The benefits of DCS options are discussed elsewhere see; PowerPoint *Plant Integration*
- Discrete systems may benefit from some kind of automation. For example assistance features around the Swing Furnace should decrease the normal operator crew by a single person when processing HZS

FOOTNOTE

- To provide the greatest benefit, automation measures are best implemented with a plant wide DCS
- The benefits of DCS options are discussed elsewhere see; PowerPoint *Plant Integration*

- Discrete systems may benefit from some kind of automation. For example assistance features around the Swing Furnace should decrease the normal operator crew by a single person when processing HZS