3ER SEMINARIO FUNDICIÓN Y REFINERÍA
26/04/2018

“Innovative Sulphuric Acid Production for high strength smelter off-gases using the CORE™ System”

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Chemetics Inc.
“Innovative Sulphuric Acid Production for high strength smelter off-gases using the CORE™ System”

- Design and Supply of Sulfuric Acid plants

- Equipment Fabricator
“Innovative Sulphuric Acid Production for high strength smelter off-gases using the CORE™ System”

Chemetics Head Office in Vancouver

Chemetics Fabrication Facility (Toronto)

Local representatives in:
- Morocco
- Tunisia
- Russia
- Chile
- Peru
- Brazil
- China
- India
1. **INTRODUCTION**

- The smelting of non-ferrous metals produces off-gases containing SO$_2$ which typically are converted to Sulfuric Acid.
- Recent innovations in smelter technologies have increased the concentration of SO$_2$ in the off-gases.
- Smelter Off-gases require additional oxygen before entering the acid plant.
- Current acid plant technologies require addition dilution of the smelter off gases to limit the SO$_2$ concentration to ~12.5 vol%.
- This presentation will briefly discuss existing technologies and then focus on an Innovative approach to dealing with higher SO$_2$ concentrations using the Chemetics CORE™ System.
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• **Conventional Sulfuric Acid Plant**

  ![Diagram of the process](image)

  - Dilution Air used to control $\text{SO}_2$ concentration below $\sim 12.5 \text{ vol\%}$
  - Results in very large acid plants to cope with diluted gas flows
  - Plant size increases as smelter Off-gas concentration is higher
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- Chemetics High Strength (CHS™) / MECS Pre-converter System

- All dilution air is mixed with a portion of smelter off-gas to create ~12.5 vol% gas
- After the CHS converter all remaining smelter gas is added
- Additional Equipment is required
  - Air/SO₂ Blower
  - Second Drying Tower
  - CHS Converter with single catalyst bed
- Not suitable for all Smelter Off-gas
- Possible to retro-fit to existing plant
- Proven and reliable equipment
- Can be operated as conventional plant at reduced rate
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- **Outotec Lurec System**

  - Recycle of process gas after bed 3
  - Increased gas flow and SO$_3$ presence reduces peak bed temperature
  - Additional Equipment is required
    - SO$_3$ recycle Blower – Tough duty!
    - Larger Converter
    - 5$^{th}$ Catalyst Bed
  - Typically not possible to retro-fit to existing plant
  - SO$_3$ Recycle Blower failure is immediate risk to plant due to overheating
  - Can be operated as conventional plant at reduced rate
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- **Chemetics CORE™ System**

  ![Diagram]

  - **SO₂** conversion in special cooled reactor
  - **Air/Oxygen** only required to maintain desired **O₂:SO₂** ratio
  - Less equipment compared to conventional plant
  - Highest energy recovery
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- **Comparison of Plant Size (Gas to Converter)**

![Graph showing comparison between Conventional and CORE™ plant size](chart)

- Plant size dependent on both $SO_2$ and $O_2$ concentrations in smelter off-gas
- CORE™ design allows use of Oxygen to reduce plant size further
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- **CORE™ (Cooled Oxidation Reactor)**
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- **CORE™ (Cooled Oxidation Reaction)**

- The Chemetics CORE™ Converter is the only commercially available isothermal converter system for SO₂ oxidation.
- Continuous removal of the reaction heat allows the process temperature to be controlled within the operating limit of the catalyst.
- Highly stable and easy to control (coolant control only)
- Standby mode keeps reactor hot during smelter interruptions
- Demonstration unit has over 8 yr operating record
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- Smelter upgrades – Acid Plant in good condition
  - Use CORE System in Add-On configuration
  - CORE System handles additional SO$_2$
  - Existing acid plant continues to operate as before
Smelter upgrades – Acid Plant in good condition

- Use CORE™ System in Add-On configuration
- CORE System handles additional SO$_2$
- Existing acid plant continues to operate as before
- Small additional investment
- Additional benefit: High Purity Acid & Steam
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Existing Double absorption Acid Plant

Ambient air

SO₂-Gas

Drying

Main Blower

HX

HX

HX

HX

Steam Boiler

Intermediate Absorber

Intermediate Absorber

Final Absorber

Stack

CORE®

Add-on Unit

SO₂-Blower

Gas-Gas Heat Exchanger

CORE™ Converter

Coolant circulation

Start-up heater

Fuel (start-up)
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- Smelter upgrades – Acid Plant in Bad condition
  
  OR

New Smelter / Acid Plant installation

- Use CORE™ System with in-line configuration
  - Double Absorption configuration
  - Single Absorption with Regenerative tail gas scrubber
- CORE System handles all smelter Off-gas
- Highest Energy Recovery using single boiler
- Smallest plant size
- Highest reliability
- Lowest investment cost
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- CORE In-line configuration (Double Absorption)
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Conclusions

• The **CORE** System allows for direct processing of high strength smelter gases without unnecessary dilution
• If Oxygen is available then a CORE system becomes much smaller and even more attractive
• Combining CORE with Regenerative Scrubbing further reduces CAPEX and improves operational flexibility and emissions
• Once a regenerative scrubber is installed it can easily be adapted to capture other $SO_2$ emissions
Questions?....

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