Sulzer Chemtech – Moving Ahead

Sulzer Static mixers for SCR DeNOx applications

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Sulzer – Company History

1775  ■ Salomon Sulzer-Bernet founds the Sulzer company
      ■ Winterthur’s first brass foundry is established:
          ■ Pumps
          ■ Fire extinguishers

1834  ■ Jakob Sulzer-Neuffert and his two sons found the company “Sulzer Brothers”

1914  ■ Family business is incorporated
Sulzer – Four divisions and Sulzer Innotec

**Sulzer Pumps**
Pumping solutions and services

**Sulzer Metco**
Surface technology solutions and services

**Sulzer Turbo Services**
Service and repair for thermal turbomachinery

**Sulzer Chemtech**
Separation columns and static mixing

**Sulzer Innotec**
Contract research and technical services
Solutions and components for separation, mixing and dispensing technology

Products and services

- Tower internals for distillation, separation, absorption and reactive distillation processes; crystallization, extraction, evaporation and membrane process equipment
- Complete skid-based separation units
- Polymerization technology
- Mixing and dispensing systems
- Associated services: engineering (process, basic & detail), piloting, tower field service

Customer benefits

- High reliability and process efficiency as single-source provider for engineering, design, equipment and services
- Profound process know-how for a wide range of applications lead to low total cost
- Cost effective solutions through innovation
- Multiple manufacturing and engineering sites ensure closeness to markets on a global basis

Approx. 3’000 employees
Sales CHF 630 Million (2009)
Market share:
- No. 1 Static mixers
- No. 1 Two component mixing/dispensing systems
- No. 2 Components for separation columns
- No. 1 Tower field services
Applications

- Chemical
- Food
- EPS
- Denox
- Polymer Production
- Oil, Gas & Refinery
- Plastics Processing
- Water & Wastewater
- Fiber Production
- Cosmetics, Resins, Pulp & Paper
Mixing and Reaction Technology
Brodest product portfolio in the industry
Leading in Technology

- More than 50 applied patents
- More than 36 years experience
- More than 100,000 references worldwide

- 1970 Invention of Static Mixing Technology (SMV-Mixer)
- 1980 Introduction of SMX
- 1985 First SMR Reactor
- 1990 First PS-production plant
- 1995 CFD-simulation
- 2002 First CompaX
- 2004 First Contour
- 2006 First EPS-production plant
- 2007 Introduction Optifoam Extrusion
- 2008 First sold PLA production plant
- 2009 Introduction of SMX plus
- 2008 First sold PLA production plant
Global customer support and global manufacturing

- Sulzer Chemtech

- Sales Offices:
  - Switzerland
  - USA
  - Mexico
  - Poland
  - Russia
  - China
  - India
  - Singapore

- Manufacturing Companies:
  - Russia
  - China
  - India
R&D and testing facilities

Capabilities

- Development / optimization of mixer geometries and designs
- CFD - flow modeling
- Laser Induced Fluorescence (LIF) for characterization of mixing performance
- Measurement of homogeneity, residence time distribution, pressure drop etc.

Pilot plants and test rigs for:

- Reaction and degassing of polymers
- Admixing of additives into highly viscous melts
- Injection molding and extrusion including foaming with physical blowing agents
- Dispersion of immiscible liquids and gas/liquid
- Mixing of liquids, gases and gas liquid
Sulzer products and services

- Static mixers for different installation sizes
  - Round ducts: **Sulzer CompaX™, Sulzer SMI™, Sulzer SMV™**
  - Rectangular ducts: **Sulzer Contour™, Sulzer SMV™**

- Ammonia Injection grids optimized for the static mixer to be used

- Wear protection coating for mixers and duct internals for operation with difficult dust (in cooperation with Sulzer Metco)

- CFD analysis and optimization of duct with AIG, mixers, turning vanes, flow rectifiers is part of the solution provided

- Physical flow modeling

- Development of static mixer configurations for equalization of dust distribution over the catalyst surface using CFD
  - For increase of catalyst life time
  - For prevention of fine dust clogging parts of the catalyst

- General analysis of large gas ducts for potential of pressure drop reductions as a service

- Performance guarantees
DeNOx system with SCR reactor

- Addition of stoichiometric amount of NH$_3$ to flue gas
- Generation of homogeneous distribution of NH$_3$/NO$_X$ ratio
- Generation of homogeneous temperature distribution (no cold spots)
- Distribution of dust to reduce peaks in erosion
- No NH$_3$ slip
Sulzer SMV™ gas mixer

- Proven mixer technology
- Used in first large DeNOx applications realized in Germany in the 1980's. Many recent US references
- Compact design
- Very short mixing length possible with specially adapted ammonia injection grid (AIG)
- Mixing process already starts within the mixer
- Low pressure drop
- Standard design includes 2 mixers
- Well suited for dust distribution
- Erosion protection by coating critical parts of the mixer as an option
Sulzer Contour™ mixer

- New mixer with optimized streamlined design (no flow detachment)
- Extremely low pressure drop
- Very good homogeneity possible (below 1% RMS if required)
- Very short mixing length possible
- Cross flow mixing over large distances
- Customizable to the mixing problem at hand
- Ideal for applications both with liquid atomized NH4OH or vaporized dosing
- Erosion protection through coating as an option
- Low weight
- On site assembly from a number of compact parts for installation in existing flue gas ducts
Sulzer Contour™ mixer

Highly optimized solution for admixing and homogenizing tasks in large rectangular gas ducts.

Very good homogeneity achieved at lowest pressure drops.

Example shows admixing of ammonia in front of SCR catalyst in a SCR DeNOx flue gas treatment unit of a large fossil powered thermal power plant.

Experimental visualisations and CFD
Erosion protection coating

- Thermal spray coating
- Arc wire based coating process
- General coating properties:
  - hard
  - ductile
  - good adhesion to substrate
- Properties of coating developed for this application
  - Hardness > 850 [HV 0,3]
  - Operating temperatures > 550°C
- Coating can be applied in the workshop (mostly automated) or on site
- Significantly increased service life time for coated surfaces even in severely abrasive environments
Applications of static mixing technology in thermal power stations

Sketch of a flue gas cleaning system with high dust SCR
Applications of static mixing technology in thermal power stations

Coal mill

Fresh air for burning

Fly ash

Load (electricity, heat)

Sulzer Mixer

Sulzer Mixer and Ammonia injection

Heater

REGAVO

Gypsum

Water, Limestone

Filter

Sulzer Mixer

Sketch of a flue gas cleaning system with tail end SCR
SCR system: Mixer configurations

- 1 row of Sulzer Contour™ mixers
- 2 rows of Sulzer Contour™ mixers

- Geometry size: 1/12 model
- Inlet massflow flue gas: 9.5125 kg/s
- Total NH₃ massflow: 2.473E-03 kg/s