Static mixers for flue gas treatment applications

S. Hirschberg | 2011
Sulzer Chemtech: Leading in static mixing technology

- More than 50 applied patents
- More than 40 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
2009 First EPS-production plant

Gas mixing | 2011 | slide 2
With Sulzer static mixing technology, you can …

- Increase NOx conversion of your SCR system
- Optimize the amount of catalyst necessary
- Reduce ammonia slip
- Achieve good DeNOx performance at all loads
- Homogenize temperature (hot bypass stream, filters, stack, …)
- Reduce operation expenses
- Increase catalyst life time
- Enhance filter efficiency
- Reduce service work

Temperature homogenization with Sulzer static mixers

Physical flow model with Sulzer Contour™ mixers

Dust homogenization with Sulzer SMV™ mixers
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

- 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
Applications of static mixing technology in thermal power stations

Sketch of a flue gas cleaning system with high dust SCR
Sulzer CompaX™ Mixer

- Ideal for dosing of small additive streams into turbulent main streams for round ducts
- Optimized geometry
- Works well for all mixing ratios between 1:10 down to 1:100000 and below
- No separate ammonia injection grid (AIG) necessary
- Homogeneous distribution after 3-5 diameters of the tube
- Low pressure drop

![Graph](image)

**Measurement plane at L/D=5**

- Results of experiments performed by BHR

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Sulzer SMI™ Mixer

- Intense mixing of streams down to homogeneities below 1% RMS if needed
- Admixing of small additive streams
- Simple optimized ammonia injection lance
- Very good homogeneity 5 – 8 tube diameters downstream of the mixer inlet
- Low surface area, widely open flow cross sections
- Low pressure drop
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
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
### References since the year 2000

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