Low Temperature NOx Abatement

Technology for a Sustainable Future

ERG offers a range of low temperature, wet scrubbing NOx removal systems for the treatment of chemically generated NOx from metal processing.

The technology selection and package design is specific to each application.

Combining ERG's strengths in gas cleaning process design, our impressive range of bespoke packed towers and patented V-tex® scrubbers, and in-house fabrication, the systems are designed to provide optimised capital and operating costs and carry a process guarantee to meet local legislation, typically <200 mg/Nm^3 NOx.

Applications

ERG's low temperature chemical scrubbing of NOx can be used for any NOx-containing air/gas process vent. Typical examples applications include:

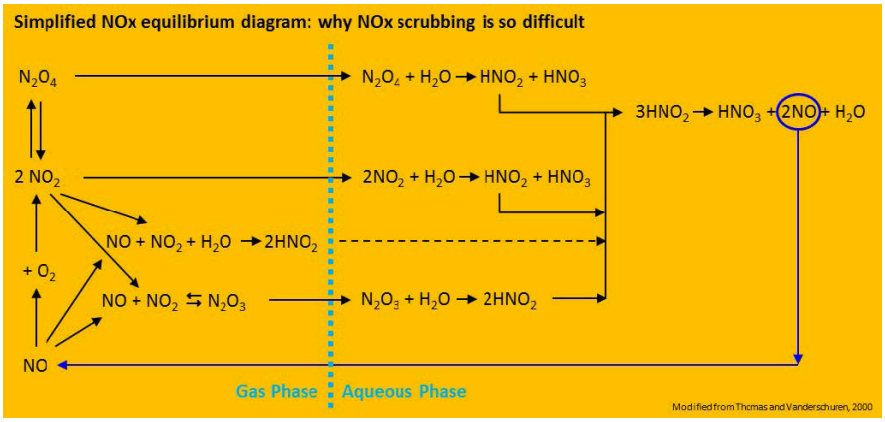
- Nitrate dissolution
- Gold and silver refining
- Rhodium solutions production
- Solutions conditioning
- Nitric acid etch
- HNO_3/HF pickling
- Aluminium brightening
- HNO_3 cleaning processes

NOx solubility – the problem and ERG's answer

Low temperature chemical scrubbing of NOx is difficult due to the low solubility of the main NOx gases (NO, NO_2, N_2O) and the competing liquid- and gas-phase equilibria which promote low solubility NOx reversing out of solution, so limiting the overall scrubbing efficiency.

NOx solubility in water or caustic solution:

- NO very low
- NO_2 low
- N_2O_3 reasonably good
- N_2O_5 very good
- HNO_3 excellent



ERG's technical approach is to take the low solubility mixture of NO + NO_2 produced by the metallurgical processing and convert this into a more soluble gas mixture of N_2O_5 or HNO_3.

Gas-phase oxidation and caustic scrubbing

The Oxidation Ratio (OR) is an important factor, defined in simplified form as NO_2 ppm / (NO ppm + NO_2 ppm). The NOx concentration emitted from the process is also an important factor. As a guide, the scrubbing selection will be:

- For OR < 0.5, gas phase oxidation prior to caustic scrubbing is necessary for high efficiency performance
- For OR > 0.5, adequate scrubbing may be possible using "equi-molar" scrubbing of N_2O_3 and excess NO_2 using simple caustic scrubbing with long residence time

ERG's approach for gas-phase oxidation of NO is by using ozone (O_3) or chlorine dioxide (ClO_2).

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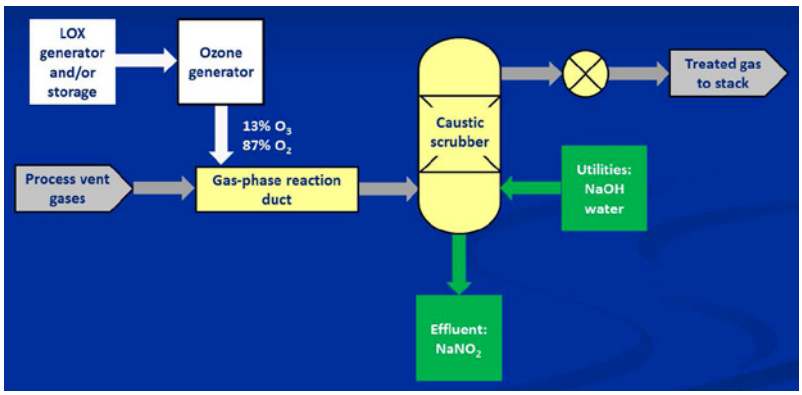
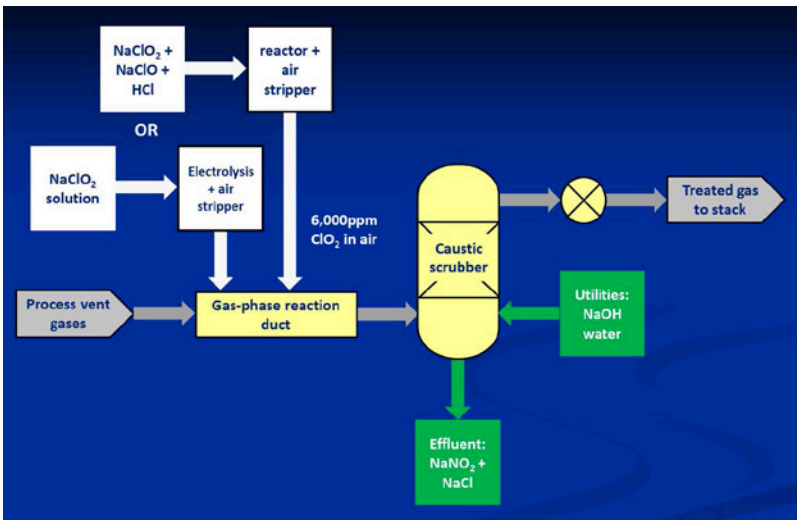
Ozone

- Generated using O_2 supply from on-site generator or LOX delivery
- Proprietary ozone generator uses electrical power and selective membrane
- Ozone/oxygen mixture is injected into the process gas stream – gas phase oxidation of NO is a fast reaction
- Ozone injection rate is measured and adjusted to achieve NO conversion and subsequent gas-phase reaction to give soluble N_2O_3 or N_2O_5 at the inlet to the wet chemical scrubber
- **Advantages** are the clean scrubber effluent (no NaCl to treat) and the possibility of product $NaNO_2$ recovery
- However the energy demand is higher than ClO_2 and the system requires the storage or generation of LOX.



Chlorine dioxide

- 1-chemical electrolysis or 3-chemical reactor depending on demand/duty
- Proprietary electrolysis cells use electrolysis of $NaClO_2$ (sodium nitrite) solution as the electrolyte to give chlorine dioxide solution and an air stripper to produce gas-phase ClO_2 in air which is injected into the process gas stream. Byproduct from electrolysis is NaOH
- Proprietary 3-chemical reactor uses $NaClO_2$, NaOCl (bleach) and HCl to produce gas-phase ClO_2 which is injected with carrier air into the process gas stream.
- Whichever ClO_2 generation technique is used, the gas phase oxidation of NO is a fast reaction
- ClO_2 injection rate is measured and adjusted to achieve NO conversion and subsequent gas-phase reaction to give soluble N_2O_3 or N_2O_5 at the inlet to the wet chemical scrubber Selection of appropriate generation method depends on ClO_2 kg/hr required based on NOx type and mass flow.
- Electrolysis is better suited to relatively small NOx demands (precious metal refining quantities) – slightly higher capital cost than 3-chem generator, but reduced operating costs.



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