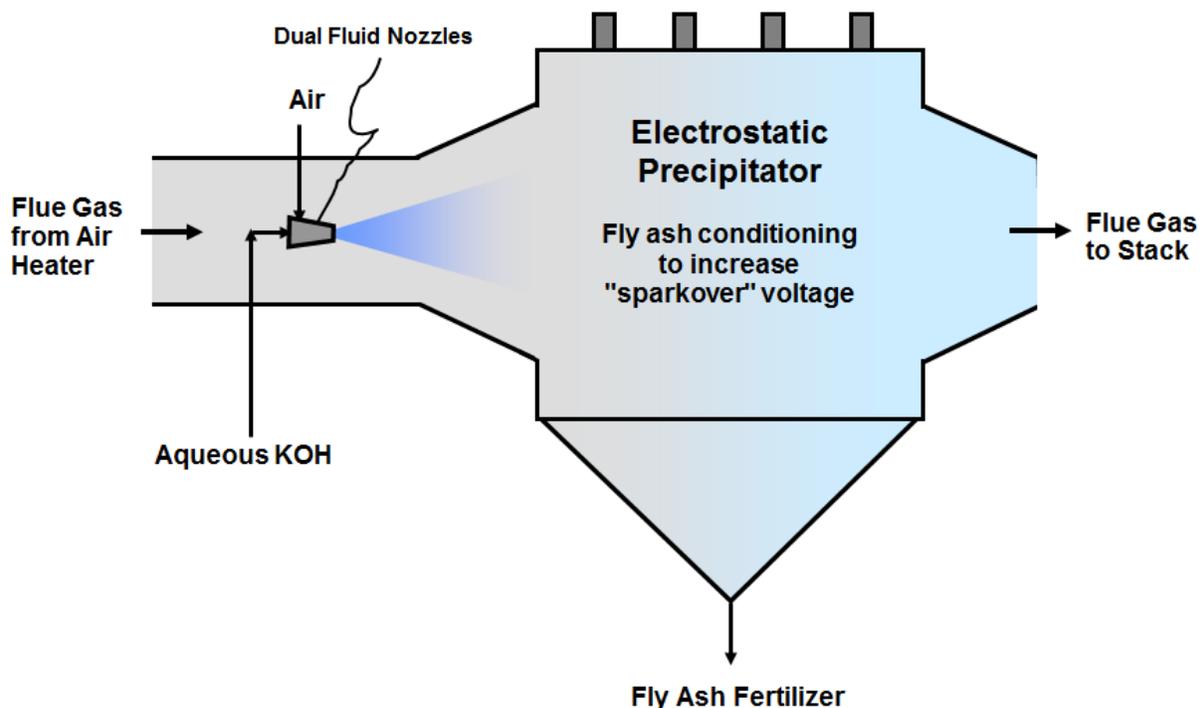


ClearStack Power, LLC



ClearGas™ Dry Scrubber SO₂, SO, NO_x, HCl and HF Removal & ESP Performance Enhancement

ClearStack Power, LLC is developing a dry scrubber called ClearGas™ that uses potassium hydroxide (KOH) to remove sulfur oxides, nitrogen oxides, hydrochloric and hydrofluoric acids from flue gases. Removal of sulfur trioxide (SO₃) also reduces flue gas opacity. The presence of potassium salts on a downstream electrostatic precipitator (ESP) increases the “spark over” voltage and improves ESP performance even though SO₃, a fly ash conditioning agent, is removed in the process. The process produces a byproduct of salable potassium nitrate-potassium sulfate-fly ash fertilizer. In 2001, a US patent was allowed for this technology, U.S. Patent 6,363,869 "Potassium Hydroxide Flue Gas Injection Technique to Reduce Acid Gas Emissions and Improve Electrostatic Precipitator Performance".



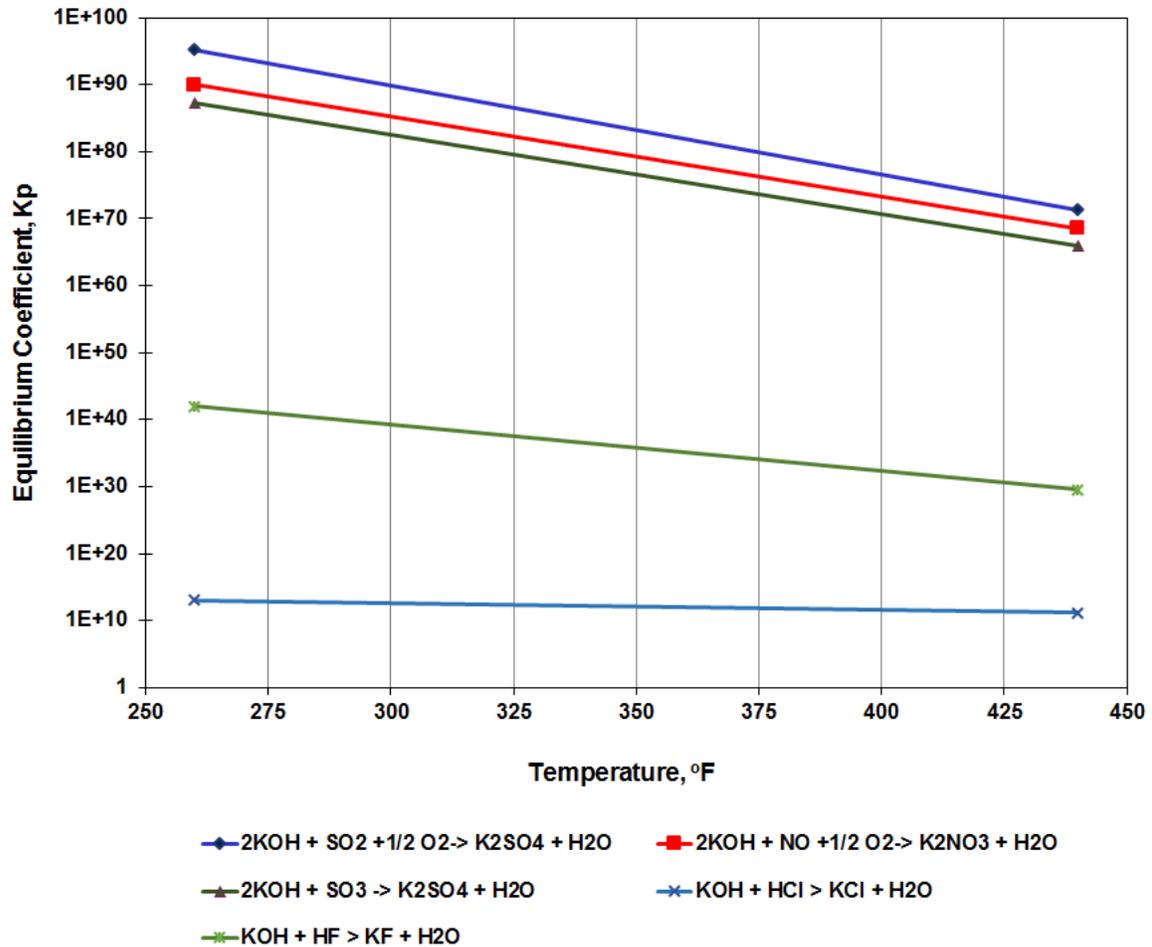
Aqueous potassium hydroxide (KOH) is spray dried into the flue gas using in-duct injection or a dry scrubber. The KOH reacts with SO₂ to form K₂SO₄, with NO and NO₂ to form KNO₃, with HCL to form KCL and with HF to form KF. See thermochemical coefficients for all four reactions below, all are highly favored. All four salts are captured and removed with the fly ash from a downstream electrostatic precipitator (ESP) or baghouse.

The presence of potassium salts in an ESP, decreases the resistivity and increases the “spark over” voltage to improve particulate removal performance even though SO₃, a fly ash conditioning agent, is removed in the process. The process produces a byproduct of fly ash-fertilizer.

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Economics show that this dry scrubber technology is a low cost technique to bring coal-fired stokers into environmental compliance. It is less costly than a stoker replacement with a natural gas-fired boiler system or a conversion to coal-fired fluidized bed systems. It will also be evaluated for niche market use on large coal-fired electric utility boilers. A pilot unit has been built (picture at top).

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