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Title: Sulfur Recovery from Acid Gas Using the Claus Process and High Temperature Air Combustion (HiTAC) Technology

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Abstract: Sulfur-bearing compounds are very detrimental to the environment and to industrial process equipment. They are often obtained or formed as a by-product of separation and thermal processing of fuels containing sulfur, such as coal, crude oil and natural gas. The two sulfur compounds, which need special attention, are: hydrogen sulfide (H2S) and sulfur dioxide (SO2). H2S is a highly corrosive gas with a foul smell. SO2 is a toxic gas responsible for acid rain formation and equipment corrosion. Various methods of reducing pollutants containing sulfur are described in this paper, with a focus on the modified Claus process, enhanced by the use of High Temperature Air Combustion (HiTAC) technology in the Claus furnace. The Claus process has been known and used in the industry for over 100 years. It involves thermal oxidation of hydrogen sulfide and its reaction with sulfur dioxide to form sulfur and water vapor. This process is equilibrium-limited and usually achieves efficiencies in the range of 94-97%, which have been regarded as acceptable in the past years. Nowadays strict air pollution regulations regarding hydrogen sulfide and sulfur dioxide emissions call for nearly 100% efficiency, which can only be achieved with process modifications. High temperature air combustion technology or otherwise called flameless (or colorless) combustion is proposed here for application in Claus furnaces, especially those employing lean acid gas streams, which cannot be burned without the use of auxiliary fuel or oxygen enrichment under standard conditions. With the use of HiTAC it has been shown, however, that fuel-lean, Low Calorific Value (LCV) fuels can be burned with very uniform thermal fields without the need for fuel enrichment or oxygen addition. The uniform temperature distribution favors clean and efficient burning with an additional advantage of significant reduction of NOx, CO and hydrocarbon emission.