Multipollutant emission control with ClO2 based technology - Technical upscaling

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A technical upscaling of a novel multi-pollutant emission control concept based on oxidation of NO to NO2 via ClO2 and subsequent wet scrubbing is demonstrated in this present work.

The investigations were conducted on a 100 kW gas-fired atmospheric oxy-fuel boiler at Chalmers University of Technology where a ClO2 generator as well as a two-stage spray tower was installed.

ClO2 gas was injected into the flue gas downstream from the boiler at various flue gas compositions (NO, NO2, SO2, O2) and process conditions in reaction zone (temperature, residence time). Furthermore, scrubber design and absorption solution properties (e.g., pH and additives) were also investigated for their influence on nitrogen and sulfur absorption. The results achieved in this technical upscaling were compared with those achieved in previous bench scale investigations.

The technical-scale trials confirmed high selectivity and efficiency of ClO2 gas to oxidize NO to NO2 at various flue gas compositions and process conditions. A complete NO oxidation to NO2 was reached at a ClO2:NO molar ratio of about 0.4 versus 0.5 for the bench scale. High absorption efficiency of SO2 in the wet scrubber was also confirmed while absorption of NO2 was somewhat lower in comparison with that of the bench scale. The lower NO2 absorption in technical scale is probably due to process related differences such as lower residence time and/or packing ratio. Crucial information was gained in the technical-scale trials both regarding the oxidation step as well as liquid chemistry and scrubber design.

The next step is to obtain proof of concept and demonstrate specific results to multiple potential customers. A mobile and flexible skid for slip stream trials has been designed and built. A Swedish waste combustion plant, Värmevärden AB in Avesta, is now scheduled to use this skid for slip stream trials to treat their exhaust gas.

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