High-Power Short Pulsed Corona: Investigation of Electrical Parameters, Abatement of SO2 and Ozone Generation

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Electrical performance and chemical activity of a 50MW, 100kV, 22ns pulsed corona was studied in simulated air-SO2 gas mixture in a coaxial reactor. Infrared and mass spectrometers and electrochemical sensors were used for gas diagnostics; solid byproducts were identified using X-ray fluorescent spectrometry. Electrochemical methods of gas diagnostics were not sufficiently reliable in view of the cross-influence of different gases, especially in ozone presence.

The removal efficiency of SO2 decreased at lower pollutant concentration and higher frequency, while the pulse energy was kept invariant. Removal efficiency in dry mixture was 25g/kWh; in humid air, it was several times greater, which is attributed to the influence of OH radicals. In dry SO2-air mixture, the removal efficiency was much higher at positive polarity.

Traces of many compounds were found and identified in treated gas. The precipitation of a yellowish powder identified as sulfur was observed. This effect was not previously noted in literature. It is ascribed to direct breaking of atomic bonds of the SO2 molecule by energetic species.

PSpice-based engineering model of corona-generator system is proposed. It was found that preliminary simulation results are in fair agreement with experimental data. The simulation revealed that surprisingly small part of the energy is coupled to plasma.