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Effect of Reactor Diameter on NOx Treatment Using Nanosecond Pulsed Powers

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Nowadays, environmental problems such as global warming, air pollution and acid rain are getting worse. Nitrogen oxides (NOx) are one of causative substances of them. NOx adversely affects not only the environment but also human body. Development of the NOx treatment measure is, therefore, an important issue. In the conventional NOx treatment method, the treatment equipment is large and expensive and requires large costs for maintenance as well. The efficient and low-cost equipment is indispensable in order for the equipment to spread even to developing countries. NOx treatment using streamer discharges generated by nanosecond pulsed powers was studied. The streamer discharges are generated in the reactor using nanosecond pulse power would treat NOx gas efficiently by plasma-chemical reactions. In order to obtain a more efficient removal treatment, adoption of thinner coaxial reactor was considered. Because streamer discharges distribute thickly around the inner wire electrode in the coaxial reactor driven by pulsed powers, the thinner coaxial reactor could utilize dense streamer discharges in the vicinity of the inner wire electrode. While the removal ratio was improved with decreasing the reactor diameter until 14 mm, the removal ratio decreased in using reactor of 10 mm. To discuss the phenomena, discharges in reactor were observed through an aperture on the outer electrode of an experimentally produced reactor. The appearance of discharges at downstream end of reactor in 10 mm reactor differed from 14 mm reactor. It was regarded as spark discharges occurred with electric field enhancement by shorter electrodes separation and voltage-wave refection at the end. However, the dependence of appearance of spark discharges on NOx removal did not become clear. Furthermore, the phenomena should be considered in detail, with waveforms of voltage and current of the reactor for an example, in order to optimize the reactor configurations for higher removal efficiency.

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