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Discussion of Discharge Distribution in Reactor and Design of Reactor for Dense Ozone Production Using Nanosecond Pulsed Power

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Ozone has been used for several applications as sterilization and deodorization because of the strong oxidizing power with low environmental load. The efficient and high-concentrated ozone-generation technology has been required. Ozone generation using nanosecond pulsed power has a feature of high efficiency but not high concentration. We have adopted a thin reactor in the ozone generation to improve the ozone concentration. The thin outer cylindrical electrode selectively utilizes high-density streamer discharges near the inner wire electrode in coaxial reactor. The ozone concentration increased but then decreased with increase in the diameter. In this study, the dependence of the state of streamer discharges in the reactor on the generated ozone was discussed. The relationship between distribution of the propagating voltage pulse in the reactor and the ozone produced by the streamer discharges was investigated when three coaxial cylindrical reactors were directly connected. The ozone concentration produced in the intermediate reactors was lower than the other two reactors. Although the voltage pulse propagated with decay in the reactors, the pulse was reflected and superimposed at the open-circuit end of reactor. Because the voltage distribution applied on the intermediate reactor would become lower, the streamer discharges in the intermediate reactor would be weak or partial. Because a part of energy of the supplied pulse was only consumed in the reactor in this experimental system, relatively long and large wave tail appeared even when a voltage pulse of 1.5 ns width was applied on the reactor. Therefore, secondary streamers and/or spark discharges, which should be inefficient for dischargechemical reaction, might occur in reactor. We have considered effect of the tail on streamer discharges with a simulated electrodes as a reactor. Here, it was considered by using the ozone producing reactor. Effective ozone production and design of the reactor was discussed based on the results.

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