

EXPERIMENTAL INVESTIGATIONS OF OZONE ZERO PHENOMENON

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Abstract. Working continuously ozone generators for many hours, in particular, under feeding high-grade oxygen, ozone concentration decreases with time, in an extreme case, becomes almost zero as described in the previous paper. Hence, we call this “ozone zero phenomenon”. This paper reports experimental investigations of the ozone zero phenomenon reproduced in order to elucidate the mechanism for the phenomenon. Auger electron spectroscopy (AES) is performed to learn further information of the electrode surface exposed to the ozone.

1. INTRODUCTION

Recently, applications of ozone to the purification of water and sewerage treatments and resist stripping in semiconductor manufacturing processes have been widely prevailed [1], [2]. For industrial purposes, since large amount of ozone are required with high concentration and efficiency, dielectric barrier discharge (DBD) or referred to as silent discharge has been employed exclusively for the ozone synthesis. Although conventional ozone generators have been operated under the commercial frequency by feeding air or pure oxygen of 99.9%, high-frequency driving by inverters and the use of the extremely high-grade oxygen is much more suitable for injecting a high-power and achieving a high concentration with attractive efficiency [3], [4].

Working continuously ozone generators for many hours, in particular, under feeding high-grade oxygen, ozone concentration decreases with time, in an extreme case, becomes almost zero. Hence, we call this “ozone zero phenomenon” [5].

In this paper, the ozone zero phenomenon is reproduced and investigated experimentally in order to elucidate the mechanism for the phenomenon. Surface analysis of electrode is carried out by means of Auger electron spectroscopy (AES).

2. EXPERIMENTAL

Figure 1 shows a schematic diagram of ozone generator. In this experiment, cylindrical ozone generator is used for investigating the ozone zero phenomenon. Outer side electrode is made of stainless steel that maintained at earth potential and has the inner surface tightly lined with glass. The internal diameter of the outer electrode is 70.3 mm. The inner cylinder is a high-voltage electrode and the surface is made of stainless steel. The external diameter of the inner electrode is 68.6 mm. Discharge gap is maintained at 0.85 mm. The length of the generator is almost 900 mm. Ion-exchange water flows in both inner and outer electrodes using a chiller, in which the water temperature is controlled to be constant during the experiments. Extremely high-grade oxygen of 99.9999% is fed into the ozone generator through a mass flowmeter, which is regulated to be 1 L/min. Ozone

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