ORIGIN OF VACUUM ULTRAVIOLET LIGHT EFFECTIVE FOR SYNCHRONIZATION OF POSITIVE SURFACE STREAMERS

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Abstract. When voltages are simultaneously applied to two spherical electrodes on an insulator plate, two surface streamers start from the electrodes are synchronized by the discharge light of vacuum ultraviolet region. This paper mainly describes an origin of this light. Two insulator plates are placed in a V-shape in the side view. A lowest point on this V-shape is a point of meeting of the insulators, and a movable shading plate is located at this point. Synchronization probabilities are measured by changing the position of the shading plate. The results suggest that the effective light is emitted from the discharge near the spherical electrode, not from the forefront of the streamer.

1. INTRODUCTION

Surface discharge phenomena have been investigated for a long time since dust figure method was established by Georg Christoph Lichtenberg in 1777. But there are many problems remaining unsolved still now, especially in detail. For example, relationship between surface streamers and discharge spectra, effective wavelength of the spectra for streamer developing, influence of photoabsorption of the discharge light on the development in various gases, supply processes of initial electrons, etc..

In 1919, Pederson [1] described Lichtenberg figures of surface streamers as starting simultaneously from several electrodes in a parallel arrangement, and the Lichtenberg figures of the streamers on an insulator plate as being isomorphic.

Recently, Chiba et al. [2] studied that surface streamers develop and spread in a regular radial pattern from one electrode on an insulator plate and this radial spread of streamers is caused by synchronous generations of all the streamer branches, similarly to the multi-electrode experiments by Pederson.

Dynamic behavior of surface streamers was modeled by Tanaka et al. [3] as follows. Observed phenomena can be reproduced by simulation only when photoelectron emission and photoionization are included. Namely, in addition to electron multiplication by collisional ionization of electrons in the area of a forefront of the streamer, it is also necessary to account for photoelectron emission from a surface of an insulator and photoionization of the discharge area.

Therefore, experimental studies have been carried out by the authors based on the idea that synchronization of surface streamers is caused by own discharge light and the light have an influence on streamer development.

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