

# EXPERIMENTAL INVESTIGATION OF CHARACTERISTICS OF AN IMPULSE STREAMER CORONA STEM USING ARTIFICIAL CLOUD OF CHARGED AEROSOL

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**Abstract.** Results of experimental investigations of impulse streamer corona stem, using artificial strongly charged aerosol cloud as a source of external field, are presented. Optical and electrical characteristics of the stem are analyzed, and conditions of its transition into the first leader spark are determined in dependence on corona electrode parameters. Significant influence of the electrode tip curvature radius on the impulse streamer corona stem parameters is found. It was established that more presumable place of stem transition into the first leader section are situated on its lateral side, but not on the tip. Relations of the stem characteristics with the impulse corona parameters for the cases of stem transition into the first leader section or its decay are determined.

## 1. INTRODUCTION

Determination of leader discharge appearance conditions is one of the important physical and practical tasks of high voltage engineering. Leader appearance under electrical discharge in long air gaps has been connected with formation of bright filament stem in the root of impulse streamer corona flash. In effect, stem is a first section of leader [7]. Though investigations of leader appearance conditions pass during the past decades, there is no agreed, clear understanding about the prevailing physical mechanisms under occurrence, development and transition of impulse corona stem into leader section. So, holistic picture of the impulse streamer corona stem life is absent now. There are not enough experimental data on conditions of the stem appearance and its transition into the leader part. Stage of the impulse corona stem appearance and development and transition into long spark channel showed less studied being in a joint between two main stage of discharge in air – streamer and leader.

Results of experimental investigations of the parameters of impulse streamer corona stem, using the artificial strongly charged cloud of water aerosol as a source of external field, are presented in the paper. In such situation, discharge processes pass under the minimally required conditions practically without any overvoltages. Received data on stem parameters for such boundary conditions could help more clearly to reveal main mechanisms under appearance and development of impulse corona stem and its transition into spark channel.

## 2. EXPERIMENTAL SETUP

The experimental setup consists of 250-m<sup>3</sup> aerosol chamber, charged aerosol generator of a condensate type, an electrode system, and a diagnostic complex. Full parameters of an experimental complex were presented in [1, 2]. It allows to create clouds of charged water aerosol have a potential up to 1.5 MV and could induce the electric fields up to 17-19 kV/cm near its boundaries and up to 6-10 kV/cm under the charged aerosol cloud near the grounded plate. Experiments were carried out under negative polarity of the artificial charged aerosol cloud. That allows the detail investigation of the stem formation of a positive impulse corona. During experiments, outlet current of the charged aerosol

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