

# Experimental investigation of surface streamers in SF6 - N2 mixtures

**Citation for published version (APA):**

Chvyreva, A. V., & Pemen, A. J. M. (2014). Experimental investigation of surface streamers in SF6 - N2 mixtures. In *Abstract of the 26th Symposium Plasma Physics and Radiation Technology, March 11-12, 2014, Lunteren, The Netherlands*

**Document status and date:**

Published: 01/01/2014

**Document Version:**

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.tue.nl/taverne](http://www.tue.nl/taverne)

**Take down policy**

If you believe that this document breaches copyright please contact us at:

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.

## Experimental Investigation of Surface Streamers in SF<sub>6</sub> - N<sub>2</sub> Mixtures

A. Chvyreva<sup>1</sup>, A.J.M. Pemen<sup>1</sup>

<sup>1</sup>*Department of Electrical Engineering, Eindhoven University of  
Technology, 5612AZ, The Netherlands*

Sulfur hexafluoride (SF<sub>6</sub>) is commonly used as a gaseous dielectric in high-voltage equipment due to its excellent insulating properties and chemical stability. However it significantly contributes to the greenhouse effect, and can under certain circumstances (after a discharge event) be poisonous for persons. Therefore, SF<sub>6</sub>-nitrogen mixtures are taken into consideration, in order to decrease the negative effects, while still keeping the required dielectric properties.

This work presents experiments on streamer discharges in mixtures of SF<sub>6</sub> with nitrogen under different experimental conditions. All experiments were performed in a specially designed vessel that allowed setting up and maintaining the parameters of gaseous environment. Discharges under investigation were streamers, propagating along the surface of an epoxy-resin dielectric. They originate on the gas-insulator interface without any contact with electrodes, and are nowadays the major cause of failure of various high voltage technologies. In the present work the voltage of discharge inception was determined for different amounts of SF<sub>6</sub>. It was shown, that the inception voltage increases rapidly starting at very small admixtures of SF<sub>6</sub> ( 5%), and continues to increase at a lower rate with the further increase of SF<sub>6</sub> percentage. The voltage of streamer inception also increases with the increase of gas pressure (in these experiments the concentration of SF<sub>6</sub> was kept constant). The velocity of discharge propagation was estimated from the analysis of time-resolved discharge current measurements. The rise-time of the current increased significantly with the addition of SF<sub>6</sub>, moreover, for high concentrations of the above the majority of the discharges were originating as leaders, skipping the streamer phase. The fall time of the current behaves in a similar way, thus the total duration of the discharge decreases almost by a factor of 10 (from tens to several nanoseconds for pure nitrogen and 5%

SF<sub>6</sub> admixture respectively).

The main conclusion of the present study is that discharge behavior changes significantly already with a small admixture of SF<sub>6</sub> to nitrogen, which gives the possibilities for organizing gas mixtures possessing the positive features of highly electronegative gases, while at the same time significantly decreasing the dangerous influence on the atmosphere.