[**Investigation of Voltage Drop across Reactance of Expanding Spark Channel**](https://ieeexplore.ieee.org/document/9263221/)

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 Abstract—A voltage drop across reactance of an expanding spark channel was numerically studied in the paper. Changes in the discharge current and radius of the conductive spark channel over time were determined by the spark expansion simulation. This data was used to calculate changes in channel inductance and voltage drop across the reactance of a spark. The analysis of the influence of energy stored in the channel inductance on the measurement of the discharge energy dissipated in the spark was carried out.

Keywords—spark discharge; voltage drop; spark reactance; channel expansion; spark simulation

 I. INTRODUCTION

The energy of a spark discharge affects reliability of ignition of combustible mixtures, a process of detonation initiation by a spark discharge, voltage recovery time of spark gaps, and a process of the erosion of discharge electrodes. Therefore, the minimum ignition energy and the critical energy of detonation initiation are determined by results of measuring the energy of a spark discharge ignited under various conditions.

A well-known method for measuring the energy of a spark discharge is based on the experimental measurement of current and voltage across the discharge gap and the subsequent calculation of the discharge energy from the results of integration of the power of energy input into the discharge gap over time. Such measurements are correct if there is no reactive load at the investigated branch of the circuit. But the discharge electrode system and the spark channel, as conductive elements, have inductance. In addition, during the development of a spark discharge, a change in the diameter of the discharge channel occurs, which leads to a change in the inductance of the spark channel over time. A change in inductance leads to a change in the reactance of the spark channel. Since the spark discharge is characterized by a sharp change in the discharge current, even when the spark inductance is small, a significant voltage drop across the inductive element can occur. Therefore, in this work, we studied the voltage drop across the reactance of an expanding spark channel. To carry out this study it requires determining the time dependence of the spark channel radius and the discharge current. It is possible to use experimental and computational methods to find out such dependencies