INVESTIGATION OF NANOSECOND DISCHARGE IN PRESSURIZED AIR SUSTAINED BY HIGH-VOLTAGE PULSES WITH DIFFERENT RISE-TIMES

S. Yatom, D. Levko, J. Z. Gleizer, V. Vekselman and Ya. E. Krasik

Technion- Israel Institute of Technology, 32000, Haifa, Israel

Results of a study of nanosecond duration discharge, supplied by high-voltage (HV) pulses of durations 1.5 and 20 ns, in discharge gaps of 1-3 cm and pressures of 1-8x10^5 Pa, are compared. Energetic runaway electrons (RAE) presence was noted and their spectrum has been derived via computer simulations compared with results of experimental x-ray absorption spectroscopy for various values of discharge gap length and pressure. The influence of the gap length and pressure on the RAE spectrum is discussed. No “anomalous” electrons were detected via both methods. It has been shown that under an atmospheric pressure the discharge sustained by 5 and 20 ns HV pulses has two distinctive stages, namely high-impedance and low-impedance stages. During the high-impedance stage the discharge gap is bridged by a plasma channel whose conductivity is not sufficient to terminate the HV stage of HV pulse, and allows an expansion of denser, secondary plasma channel across the gap and a further generation of RAE as well. It has also been shown that in case of 5 and 20 ns HV pulses RAE with energies ≥15 keV are only generated during the low-impedance stage and thus are not responsible for discharge ignition.