Dynamics of near UV radiation in the near-electrode region at pre-breakdown stage of long spark

A.V. Oginov, A.A. Rodionov, K.V. Shpakov

LPI of RAS, Moscow, Russia, konstantine.shpakov@gmail.com

The experimental investigation of long high voltage discharge was carried out. Discharge parameters: voltage amplitude is about 1 MV; current amplitude is about 10 kA; gap is about 0.5 m. Medium: air at atmospheric pressure [1]. The electrodes with a radius of 45 mm to less than 1 mm were used.

The measurement of visible and UV radiation, which arises at the discharge development initial stage, showed that the UV radiation starts in the high voltage electrode area at voltage rise. The radiation spectrum is extending in long-wave region with time [2]. In [2] the limit of detector sensitivity was 240 nm. Measurements of UV radiation with wavelength under 240 nm were made with the new detectors based on Hamamatsu PMT.

The near UV radiation (which arise in the gap region at the discharge development initial stage) dynamics investigation results were presented. The correlation between UV radiation and current behavior was showed. The near cathode region with a diameter of 50 mm was investigated. The results of the investigation of the occurrence time and dynamics of the UV radiation from near cathode region were presented.

The “interrupted discharge” experiments (with a voltage switch off before breakdown) were carried out. The correlation between the UV radiation and the supplied voltage pulse duration was showed.

The correlation between the UV radiation pulse shape and the hard X-ray (which also arises at the discharge development initial stage) pulse characteristics was investigated.

The correlation between the cathode shape, which affects near cathode electric field intensity, and UV radiation characteristics was investigated. It was determined that the UV radiation pulse front arises during narrow time interval (< 50 ns). The correlation between this time interval width and the cathode radius was showed.

References

1. A.V.Oginov, S.A.Chaikovskyi, V.A.Bogachenkov et al. Scientific Session NRNU MEPhI -2010. Abstracts, Vol. I. 2010. p. 197
2. A.V.Oginov, K.V. Shpakov. Uzhhorod University Scientific Herald. Series Physics., 2011, issue 30, p. 233-240.