THE DEVELOPMENT OF POTENTIAL ELECTRODE NEW CONSTRUCTION WHICH IS CATHODE FOR OBTAINING OF NANO-SECOND VOLUME DISCHARGE GLOW IN THE AIR AT ATMOSPHERIC PRESSURE

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The present paper is dedicated to investigations of nano-second pulsed discharge in the air at the atmospheric pressure. The new construction of potential electrode, which is cathode with use of dielectric porcelain and fluoroplastic capping, has been developed. The influence factor of capping on the rod with radius of curvature r=1mm on charge glow region size is shown. The mechanism of discharge glow region expansion with formation of "running electrons" in cathode plasma has been considered.

The investigations of electric discharge in molecular gases (air, nitrogen, CO_2 and etc) show that the appearance of volume glow of diffusion type is observed at enough small high voltage pulse width applied to discharge gap. Moreover, the discharge current is usually decades of ampere. The volume discharge at impulse width increase transits into constricted bright spark channel. The existence conditions and properties of volume discharge aren't clear yet though the many scientific papers are dedicated to their investigation [1].

The given paper is dedicated to investigation of nano-second pulsed volume discharge glow in the air of atmosphere pressure on potential electrode of dielectric cappings.

The nano-second high voltage generator with voltage amplitude on output 80kV with 8ns impulse front width has been developed for investigation carrying out. The asymmetric system of electrodes with strongly homogeneous field "rode-plane" has been chosen. The interelectrode distance d is varied in limits 3-15 mm. The metallic grid with step 1,5mm serves as anode. The voltage impulse of negative polarity is applied to rode which is cathode with radius of curvature r=1мм. The porcelain tube is put on the rod with the aim of focusing of charged particle flow. The tube position is varied in respect of rod end in limits 1-5mm. The fluoroplastic capping of squared shape is put on porcelain for obtaining of volume charge glow. Its position in respect of the tube hole is also varied in limits 1-5 mm. The pulsed discharge is photographed with the help of digital video camera Samsung 3500 Digimax 5.1x disposed behind anode. At such camera position one can photograph the nano-second volume discharge glow and define the influence factor of dielectric cappings on cathode on glow region expansion.

As it is above mentioned, firstly the porcelain tube, the position of which is varied in respect of the rod end, is put on rod with radius of curvature r=1mm. The photo of pulsed discharge when the tube is extended on 5mm in respect of the rod end is shown on fig.1. Then the fluoroplastic capping is put on porcelain; the tube positions in respect of the rod and fluoroplastic capping positions in respect of porcelain ones are varied simultaneously. The discharge photos at such cathode configurations are given on the fig. 1 (b, c).

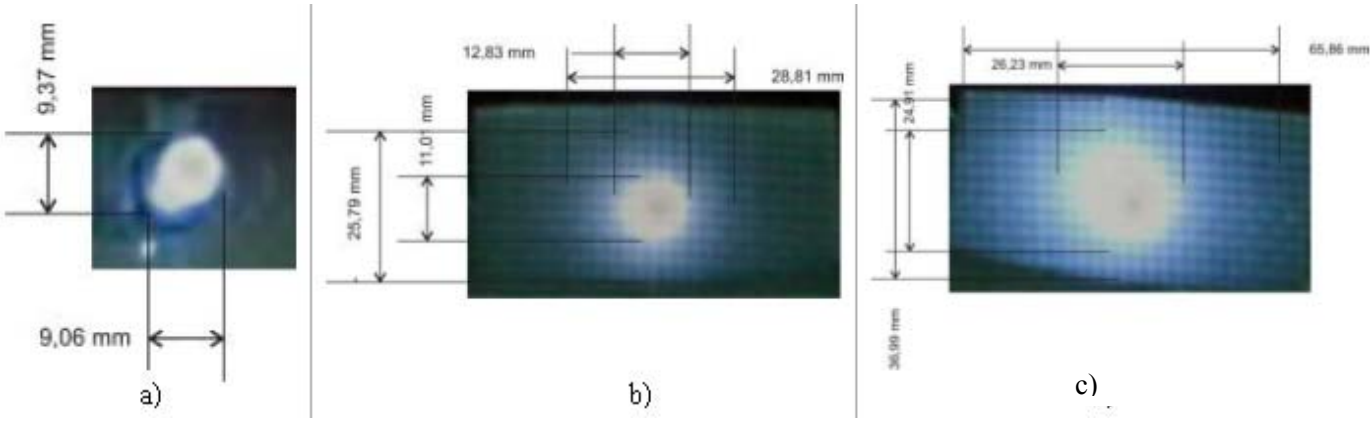

Fig.1. The photos of nano-second discharge glow at negative voltage polarity on potential electrode-rod (r=1мм) with different dielectric cappings at different interelectrode distances d.
a- p=1атм, r=1mm, d=10mm, porcelain tube is extended on 5mm in respect of rod end;
b- p=1атм; r=1mm, d=5mm, porcelain tube is extended on 1mm in respect of rod end; the fluoroplastic capping is extended on 3mm in respect of porcelain end;
c -p=1атм; r=1mm, d=15mm, porcelain tube is extended on 4mm in respect of rod end; the fluoroplastic capping is extended on 3mm in respect of porcelain end.

As it is seen from the fig.1 the presence of bright white glow of cathode captured by diffusion violet glow is common fact for discharge glow photos. The violet glow probably corresponds to decay lag of nitrogen excited molecules (second positive band system) [2]. The observable white glow is radiation of cathode plasma with relatively high temperature. The sizes of discharge glow region are on all photos.

The region of bright white glow expands from 9mm up to 13mm at the presence of only porcelain tube on rod-cathode and at simultaneous use of both dielectric capping it expands up to 27mm (in 3 times)

Similar region expansion of nano-second pulsed discharge glow in the air at atmosphere pressure at the presence of dielectric cappings on potential electrode one can explain by the following way. From works [3,4] it is known on advantages of dielectric capping use on voltage of power frequency for surface modification of composition material components and also for existence of stable flare discharge in each positive semi-period of alternative voltage.The porcelain capping serves for focusing of charged particle flow in the strong field region and fluoroplastic capping serves for accumulation of negative ions on its surface.

In our case the same situation with impulse voltage takes place. The microexplosions from cathode surface leading to formation of "running electrons" actively taking part in ionizing processes near cathode and further movement of discharge channel to the depth to anode, take place at the supply on potential electrode of nano-second impulse voltage of negative polarity because of crytical electric field strength near cathode. The positive volume charge forming at this situation accumulates on the surface of fluoroplastic capping because of its small mobility, causes to field intensification near cathode [5,6] and to field change in the zone"cathode – porcelain - fluoroplastic". As a result of this the ionization processes with"running electrons" participation have the more wide limits and distribute far from ionization primary centers that leads to expansion of discharge glow region. This phenomenon leads to formation of big namber of discharge active products that can be effectively used for effective purification of atmosphere from harmful impurities in whole volume of reaction chamber.

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HAVADA ATMOSFER TƏZYİQİ ŞƏRAİTİNDƏ NANOSANİYƏ QAZBOŞALMASININ HƏCMLİ İŞIQLANMASINA NAİL OLMAQ MƏQSƏDİLƏ YENİ KONSTRUKSİYALI POTENSİAL ELEKTROD-KATODUN İŞLƏNİLMƏSİ

Məqalə atmosfer mühitində normal təzyiqdə nanosaniyə impuls qazboşalmasinin tədqiqinə həsr olunmuşdur. Farfor və ftoroplastdan hazırlanmış dielektrik başlıqları olan katodun – potensial elektrodun yeni konstruksiyası işlənilmişdir. Göstərilmişdir ki, əyrilik radiusu - *r*=1mm olan elektrodun üzərində yerləşdirilmiş başlıq qazboşalmasının işıqlanma sahəsinin ölçülərinə nə dərəcədə təsir edir. Katod oblastında "qaçan elektronların" əmələ gəlməsi vasitəsilə işıqlanma sahəsinin genişlənməsinin mexanizminə baxılmışdır.

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РАЗРАБОТКА НОВОЙ КОНСТРУКЦИИ ПОТЕНЦИАЛЬНОГО ЭЛЕКТРОДА – КАТОДА ДЛЯ ПОЛУЧЕНИЯ ОБЪЕМНОГО СВЕЧЕНИЯ НАНОСЕКУНДНОГО РАЗРЯДА В ВОЗДУХЕ ПРИ АТМОСФЕРНОМ ДАВЛЕНИИ

Настоящая статья посвящена исследованиям наносекундного импульсного разряда в воздухе при атмосферном давлении. Разработана новая конструкция потенциального электрода – катода с использованием диэлектрических насадок из фарфора и фторопласта. Показана степень влияния наличия на стержне с радиусом кривизны - r=1мм на размеры области свечения разряда. Рассмотрен механизм расширения области свечения с образованием в прикатодной плазме "убегающих электронов".

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