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Research Article

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Light Energy Production by the Photo Initiated Chain Reaction in Atmospheric Air

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Abstract

The white light of Light Emitting Diodes (LED) lamp is propagating along the axes of tube 110 mm in diameter with light reflecting walls. Light radiation is observed from the holes drilled in the side surface of the tube. Intensity of this radiation does not depend on the length of the tube and on the number of holes. This Phenomenon is explained with photon multiplication due to photo-initiated chain reaction in atmospheric air, which compensate photon losses caused by radiation through holes. For this reason the total radiation intensity from all holes exceeds the radiation intensity used for photo initiation. Chemical Mechanism of photon multiplication is proposed.

Keywords: Atmospheric Air, Chain Reaction, Photo Initiation, Exited Molecules, Stimulated Radiation, Spontaneous Radiation, Photon Multiplication, Photon Balance, Light Energy Production

1. Introduction

Irradiation of atmospheric Air in the Reactor with light reflecting walls by the pulse of visible or UV light produces light flash [1,2]. Properties of these flashes demonstrate existence of a chain reaction with photons and exited complexes as active centers [3]. An important property of light beam, propagating in atmospheric air is absence of remarkable diminishing of its intensity until the optical path length is less then several tens of kilometers [4]. This phenomenon was explained in different ways. Authors of stated about very small absorption cross-section of O2-O2 collision pairs [4]. In contradiction to this statement in a conclusion was made about stimulated emission of radiation by exited molecules, which returns to the beam all absorbed photons [3]. Spontaneous Radiation from active zone of the light beam was also observed in [3]. It resulted in loss of photons in surrounding air [3]. Some loss of photons take place also in reactors with light reflecting walls [1,2]. The light flashes are produced nevertheless [1,2]. It enables one to state about existence of photon multiplication process and applicability of photon balance equation

$$dN/dt = w_0 + f(N)*N - g*N \qquad (1)$$

where N is the photon concentration, w0 is the photo initiation intensity, f(N) and g – the rates of multiplication and loss of photons, respectively. Production of light flashes is possible, when (f-g) > 0. At such condition the flash produces light energy amount, which can exceed the energy used for photo initiation. Such Situation is imaginable in case of exothermal chain reaction. But the photo initiated chain reaction in air does not result in some stable products: the exited complexes dissociate after photon emission event. Absence of products does not enable one to ascribe any chemical energy production to discussed chain reaction. But the thermal energy of air mixture can be responsible for producing of Light Energy.

Relation of "f" and "g" factors depends on S/V [5] (S - the total area of holes in the side surface of cylindrical reactor with light reflecting walls, V – the volume of reactor). When the tube 25 mm in diameter was used, the diminishing of light intensity with the length of the tube was observed [3]. One can propose, that using of bigger tube as a reactor will result in obtaining of very long light source, producing very big amount of light energy radiated from holes in the side surface of the reactor.

Experimental proof of the assumption made above was the goal of this work.

2. Methods of the Experiment

The tubes 110 mm in diameter covered with Al foil from inside were used as reactors in this work. Holes of 40 mm in diameter were drilled in the side surface of the tubes. The distance between holes changed in different cases from several centimeters to 20 centimeters. Photo camera Sony DSC-S650 was used for light intensity registration and evaluation. The 7 W lamp SAFIT SBC3707 (produced by Ningbo Yusing Lighting Co., Ltd. No. 1199, Mingguang Road, Jiangshan Town, Ningbo China) with Light Emitting Diodes (LED) was used (see Fig. 1) for photo initiation.

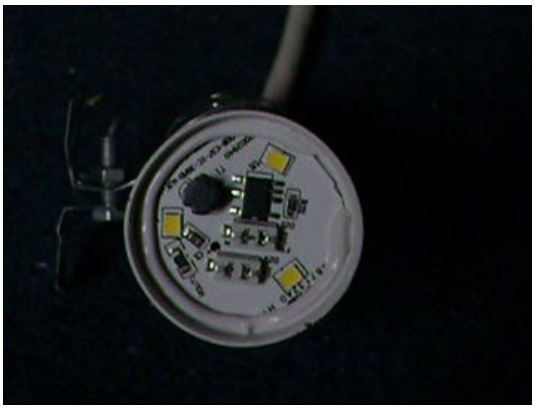

Figure 1: The 7W LED Lamp after Removing of Shade

3. Results of Experiments

Two frames of video are placed on Figure 2: with 20 opened holes on the tube (at the left part of the Figure) and with 1 opened hole (at the right part of the Figure). Two facts can be noted: 1) intensive radiation from opened holes is observed; 2) no differences between intensities of radiation from different holes can be observed. So one can conclude: 1) in contradiction to [4] the lamp radiation strongly interacts with atmospheric air; 2) the loss of photons through holes is compensated by photon multiplication in the reactor. In absence of such compensation the intensity of light beam, propagating along the tube, is expected to diminish with distance (according to energy conservation law).

Figure 2: Photo of Radiating Holes on the Tube 110 Mm in Diameter in Cases of 16 Opened Holes (On the Left Part of Figure) and Only 1 Opened Hole (On the Right Part of the Figure)

Absence of noticeable deminishing of radiation intensity is observed in cases of 1 m, 2 m, 3 m and 4 m long tubes (see Figure 3). Intensity of radiation produced through the holes of the tube is enough for practical usage, as can be seen at the Figure 4.

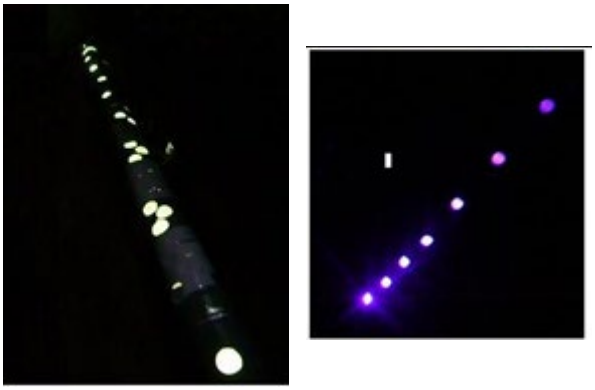

Figure 3: Photo of Radiating Holes in Case of 4 M Long Tube. It Was not Possible to Obtaine the Image of Whole Tube on One Frame. So Two Frames Represent Two Different Parts of the Tube

What result could be obtained in case of using 1000 m or more long tube with more then 5000 holes? Taking into account the results presented above, one can propose the same: all 5000 holes will radiate with equale intensity.

Figure 4: Two Meter Long Tube Radiator with 8 Holes Was Disposed in the Corner of Room, In Absence of Windows. There was Enough Light Under the Radiator to Read Books Ore to Make Any Hand Work

4. Discussion of Results

In contradiction to conclusions of [4], the light beam propagating along the tube axes strongly interacts with air molecules, resulting in radiation through holes drilled in the side surface of the tube. The energy of this radiation is added to the energy of the main beam, which does not deminish with the distance from the light source in accordance with [4].

Obtained results enable one to propose that in case of using enough long tube 110 mm in diameter with light reflecting walls the total light energy radiated through the holes will exceed the energy of the lamp, used for photo initiating of the chain reaction. At this basis the conclusion about light energy production by the photo initiated chain reaction in atmospheric air can be made. High enough concentration of singlet oxigen dimole complexes $O_2(^1\Sigma)$-$O_2(^1\Delta)$ is needed for starting this process:

$$O_2\,(^1\Sigma) - O_2\,(^1\Delta) + hv \Rightarrow O_2\,(A\,^3\Sigma, E=4.3\ eV)\ [6] \quad (1)$$

$$O_2\,(A^3\Sigma) + N_2 + M \Rightarrow O_2(A\,^3\Sigma)\text{-}N_2(E=5.3\ eV) + M\ [3] \quad (2)$$

$$O_2\,(A^3\Sigma) - N_2\,(E=5.3\ eV) + hv \Rightarrow O_2\text{-}N_2(E=2.65\ eV)+2hv \quad (3)$$

$$O_2\text{-}N_2\ (E=2.65\ eV) + hv \Rightarrow O_2 + N_2 + 2hv \quad (4)$$

Here hv – relates to blue photon with energy 2.65 eV.

Reactions (1)-(4) result in photon multiplication. Extra energy (additional to photo initiation energy) comes from reaction (2) and processes of singlet oxygen production [7]. It should be noted that conversion of white light to blue in atmospheric air was observed recently [8].

5. Conclusions

Intensive light radiation from the holes in side surface of the tube 110 mm in diameter is observed when the light beam from the LED lamp propagates along the axes of the tube. The intensity of the propagating light beam does not diminish with the distance from the lamp. In this case the light energy produced by the radiation from holes can be considered as additional to the energy of the lamp. This additional energy rises with enhancing tube length and the number of holes on it.

Such tube 1000 m long will illuminate hundreds of rooms by using only one 7 W lamp.

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