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Transformation of White Light to Blue in the Atmospheric Air

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ABSTRACT

Photo initiation of Air inside the reactor with light reflecting walls produces the chain reaction, which leads to formation of excited complexes O2(A $^3\Sigma$)-N2, emitting blue photons. O^3 molecules also formed in the active medium of chain reaction completely sorb the white light of the initiating lamp. So instead of the white light the blue light is emitted from the holes at the cylindrical surface of the reactor.

Introduction

The Literature data about optical absorption in the atmospheric air are contradictory [1,2]. The blue color of sky was explained with Raley scattering by Air molecules [3]. There is no data about chemical Nature of blue Color of Sky. In the article [2] the emission spectrum of Photo Initiated Chain Reaction (PICR) in the Air was presented. It contains blue, green and red bands, which were ascribed to excited complexes O2(A $^3\Sigma$)-N2, O(^{1}S)-N2 and dimole complexes of singlet oxygen respectively. Appearance of O atoms in the active medium of chain reaction enables one to state about the O_3 formation. The O_3 Absorption Spectrum contains the Chappus Band at the wave lengths from 440 nm to 850 nm. After photon absorption the O3 molecule decomposes, resulting in atom O formation [4]. Excited complex O(^{1}S)-N_2 radiation results in atom O(^{1}D) formation and after that the singlet oxygen molecules are formed. Absorption by singlet oxygen dimole complexes results in formation of O_2(A $^3\Sigma$, E=4.3 eV) [5], which produce excited complexes O_2(A $^3\Sigma$)-N_2. For these complexes the radiation of two blue photons is energetically possible. In such case one could state about blue photons multiplication: one blue photon absorption by singlet oxygen dimole complex would lead to radiation of two blue photons. The result of described above processes would be the disappearance of white light and appearance of blue. The experimental proof of the made above statement was a goal of presented investigation. The tube 200 mm in diameter and 1 m long was used as the reactor.

The tube was covered by aluminum foil from inside. In the cylindrical surface of the tube the holes 40 mm in diameter were drilled (see the right part of the Figure 1). One end of the tube was covered with foil too. At the open end of the tube the flash lamp was placed. The flash lamp was equipped with xenon lamp as radiating element. The white screen was placed parallel to the tube at the distance 0.5 m from it. After the flash of lamp, the screen was illuminated by blue light (see the left part of the Figure 1). For the registration of such illumination the video recording by digital camera Nicon Coolpix L25 was used. When instead of flash lamp the continuously working lamp with LED (Light Emitting Diods) was used, the white light from the holes was observed (see the right part of the Figure 1). Figure 1 The white screen is illuminated by blue light coming from holes at the tube described above (left part of the Figure 1).

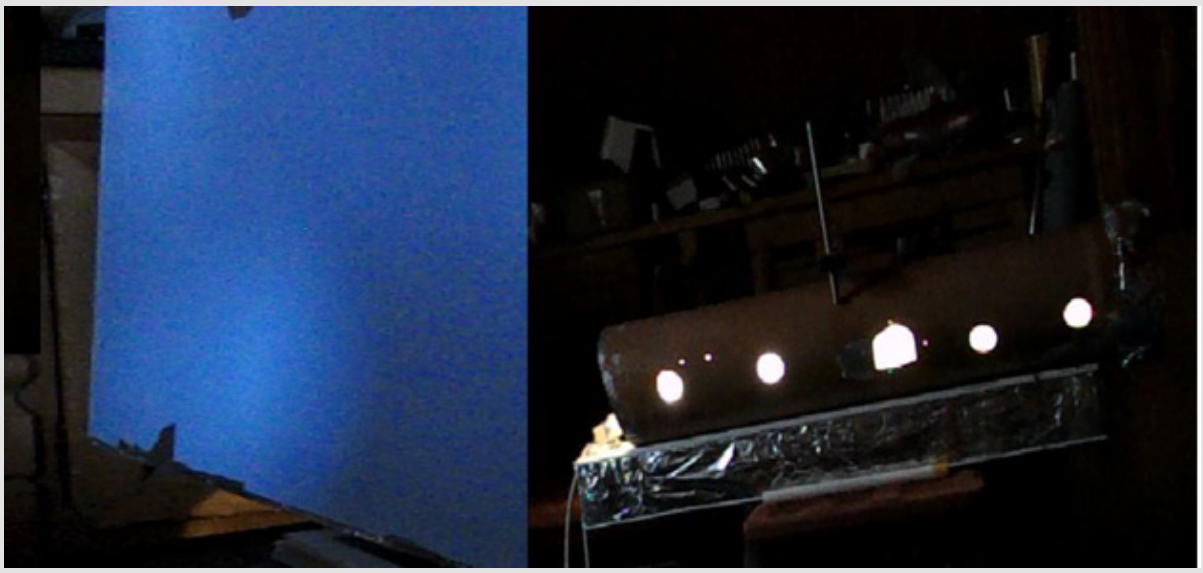

Figure 1.

Discussion

What is the nature of radiation coming from holes at the tube? According to the data of [2], the light of LED lamp initiates the chain reaction in the tube. That reaction forms the transient products N_2-$O(^1S)$, N_2-$O_2(A\ ^3\Sigma)$ and dimole complexes of singlet oxygen, which are radiating green, blue and red light respectively. Interaction of LED radiation with excited molecules produces stimulated emission of radiation directed along the tube. The spontaneous emission of radiation produces the light, coming from holes and directed at different angles to the tube axe. When (in case of using the flash lamp) the enough high concentration of complexes N_2-$O_2(A\ ^3\Sigma)$ is achieved, the stimulated radiation of blue color develops directed perpendicularly to the tube axe. This process is accompanied by multiplication of blue photons. The blue radiation becomes dominating over green and red. Also, a high concentration of O_3 is achieved. This leads to the complete disappearing of white light from radiation, coming from the holes. Blue color of observed radiation does not differ from the color of sky. One can propose that the same process (initiated by sun light) develops in the atmosphere.

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