

Fullerene-Oxygen-Iodine Laser (FOIL). The Problem of Singlet Oxygen Generator with Optical Pumping of Fullerenes (State-of-Art)

O. B. Danilov¹, I. V. Bagrov, I. M. Belousova, V. M. Kiselev,
T. D. Murav'eva and E. I. Sosnov

SIC "Vavilov State Optical Institute", Institute for Laser Physics, Birzhevaya line 12,
199034 St. Petersburg, Russia

The outlook of Singlet Oxygen Generator (SOG) with optical pumping of fullerene solution (or suspension) using the principle of the centrifugal bubbling apparatus is considered. Scheme of fulleren-oxygen-iodine laser (FOIL) with such a SOG is discussed.

In the paper are discussed two main directions of the singlet oxygen generator development for FOIL – (1) solution of C₆₀ and O₂ in CCl₄ and (2) suspension of the capsulated fullerenes in C₆F₁₄ with the dissolved oxygen (note, that C₆F₁₄ in its gaseous state is one of the best buffer gases for iodine lasers).

There was investigated the behavior of the key for the optically pumped singlet oxygen parameter – its lifetime in liquid medium. It was shown in experiment that the lifetime of the ¹ΔO₂, generated in solution of C₆₀ and O₂ in CCl₄ exceeds 50 msec. There are presented the results of investigation of the singlet oxygen luminescence photoinduced quenching in solution of C₆₀ and O₂ in CCl₄. It was shown that the action of the intense pumping radiation, containing the UV component, results in production of the long lifetime complexes of oxygen and fullerenes, which are the efficient quencher of ¹ΔO₂. The lack of the UV component results in practical elimination of the said effect. Hence, the theoretical estimations and the experimental results show that it is possible to obtain the lifetime of the dissolved singlet oxygen in 50 msec and more. This makes it possible to organize the efficient output of ¹ΔO₂ to gaseous phase by means of vacuum evaporation of the medium with the preservation of the concentration ratio of [¹ΔO₂]/[O₂] ≈ 1:1. The problems of scaling of singlet oxygen generator are considered.

Experimental results of the singlet oxygen extraction from the mentioned above solution by the buffer gas (Ne) bubbling in the condition of the natural gravitation are presented. Conditions and the possibility to use the centrifugal bubbling apparatus for elaboration of the singlet oxygen generator with optical pumping of fullerenes are discussed.

¹ E-mail: ob-danilov@yandex.ru, phone: +7 (812) 3285734, fax: +7 (812) 3285891