Two-color REMPI [(1+1')+1] of the singlet oxygen $^1O_2$ arising in UV-photodissociation of van der Waals complex C_5H_8–O_2

Alexandr Bogomolov[1], Nikolay Dozmorov[1], Sergei Kochubei[2], Alexey Baklanov[1]

1) *1. Voevodsky Institute of chemical kinetics and combustion 2. Novosibirsk State University*
2) *Rzhanov Institute of Semiconductor Physics*

Photochemistry of the molecular oxygen is important for manifold of atmospheric and photobiological processes. Van der Waals complex of oxygen X–O_2 has been shown to be a good model for the study of UV photophysics and photochemistry of the oxygen perturbed by environment [1]. The new supramolecular photoprocesses in X–O_2 complexes have been revealed. One of them gives rise to the singlet oxygen $O_2(a^1\Delta_g)$ which is interpreted to be due to supramolecular transition in complex with simultaneous change of the spin of complex partners (double spin-flip) [2]:

$$^3(^1X—^3O_2) + h\nu \dashrightarrow {}^3(^3X—O_2(a^1\Delta_g)) \dashrightarrow {}^3X + O_2(a^1\Delta_g)$$

The singlet oxygen formation was detected with its photodissociation by the same laser pulse with formation of two atoms with specified kinetic energy measured by velocity map imaging technique (VMI). Spectral range of one-laser experiments is limited by wavelength of REMPI of oxygen atoms near 225 nm. Another way to detect the singlet oxygen is REMPI (2+1) itself in spectral range 300–340 nm [3].

In present work the one-laser approach for detection of the singlet oxygen is applied with two color REMPI [(1+1')+1] of singlet oxygen where dye laser radiation (455 – 469 nm) and its second harmonic are used simultaneously. In this approach the same excited intermediate states of O_2 have been used. UV-radiation wavelength is within the spectral region of 227–235 nm where photodissociation of the Van der Waals complex of isoprene with oxygen C_5H_8–O_2 is known to give rise to singlet oxygen [2]. This approach in combination with VMI has been applied to detect the singlet oxygen arising from van der Waals complex C_5H_8–O_2.

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