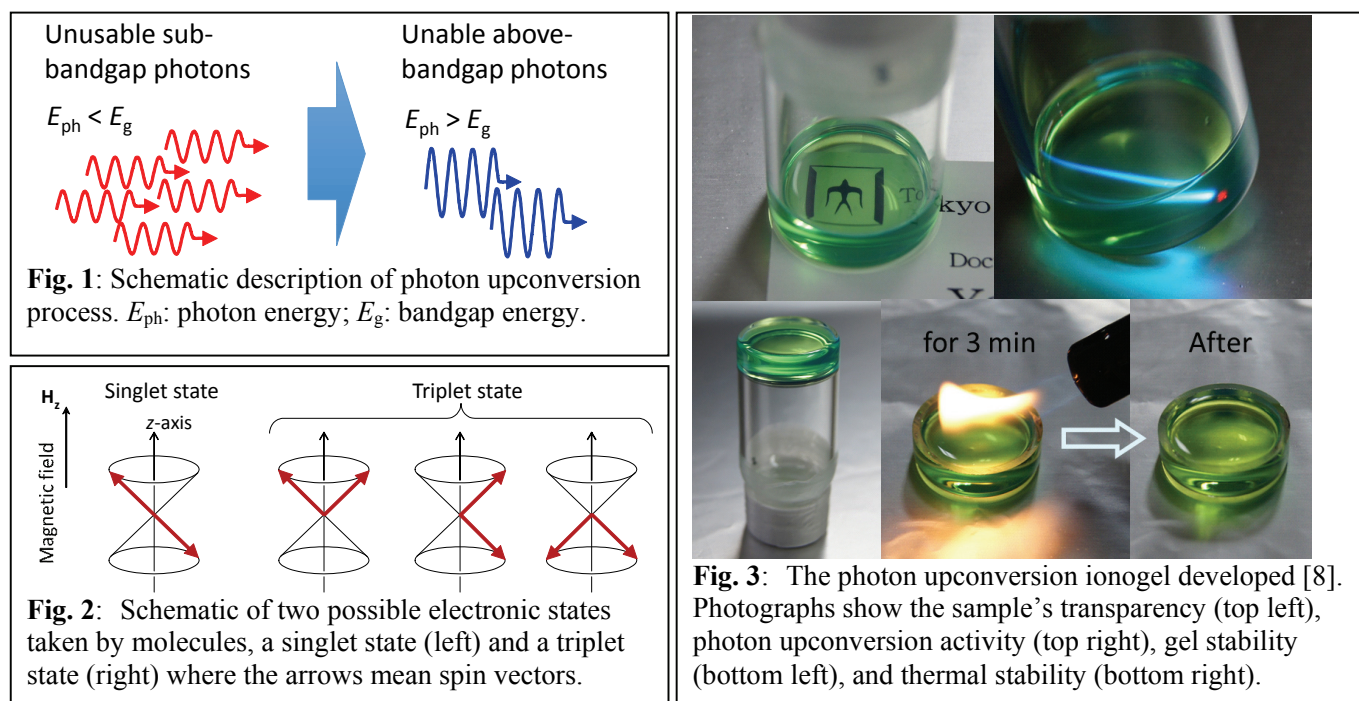


Kinetics and transport properties of triplet-sensitized photon upconversion in fluids and gels

Yoichi Murakami

School of Engineering, Tokyo Institute of Technology, 2-12-1-11-15 Ookayama, Meguro-ku, Tokyo 152-8552, Japan

Presently, sizable portion of energy of light, such as sunlight, are irreversibly wasted in broad photo-conversion technologies because only photons with higher energies than the materials bandgap energy (E_g) are used while those with lower energies than it cannot be used for secondary energy generation. This has been posing an essential limit to the energy conversion efficiencies of these systems. However, if one can convert, under the thermodynamics laws, these wasted low energy photons into above-bandgap photons as depicted in **Fig. 1**, the engineering consequences will be significant. The technology that carries this out is called “photon upconversion (UC)”. Recently, a method of UC that uses triplet states (**Fig. 2**) of organic molecules are drawing attention, because this is presently the only UC technique that can apply to low intensity and non-coherent lights such as sunlight and LED light [1,2]. Our group has been carrying out new materials development and fundamental investigations to elucidate the underlying kinetic that governs the UC efficiency [3-8], as exemplified by **Fig. 3**. In the Joint Seminar, the kinetics and transport properties of the UC samples revealed through our investigations will be presented.



- [1] F. N. Castellano et al., *Coord. Chem. Rev.* **254**, 2560 (2010). [2] T. F. Schulze et al., *Energy Environ. Sci.* **8**, 103 (2015). [3] Y. Murakami, *Chem. Phys. Lett.* **516**, 56 (2011). [4] Y. Murakami, *Thermal Sci. Eng.* (Heat Transfer Society of Japan) **20**, 15 (2012). [5] Y. Murakami et al., *J. Phys. Chem. B* **117**, 2487 (2013). [6] Y. Murakami et al., *J. Phys. Chem. B* **117**, 5180 (2013). [7] Y. Murakami et al., *J. Phys. Chem. B* **118**, 14442 (2014). [8] Y. Murakami et al., *J. Phys. Chem. B* **120**, 748 (2016).