Technology from Kyoto University

Small-Sized Molecule with a Large Two-Photon Absorption Cross-Section

We are looking to out-license the technology for its commercialization.

High-performance two-photon absorption material developed through molecular design based on vibronic interaction density theory

◆Background

With two-photon absorption where an electronic excitation process in which a single molecule or cluster absorbs two photons simultaneously to reach an excited state, it is possible to selectively induce photoexcitation only in small regions of high light intensity, as well as to use near-infrared light (700–1300 nm), which has high tissue penetration, to achieve similar transitions. However, conventional two-photon absorption materials have faced challenges, such as a small two-photon absorption cross-section and large molecular size. This has led to issues like reduced light absorption efficiency, limited applicability, and potential impacts on biological systems.

◆Description

Kyoto University researchers have applied molecular design rooted in vibronic coupling density (VCD) theory to develop a two-photon absorption material characterized by a large two-photon absorption cross-section and compact molecular size. Moreover, since this material emits in the near-infrared region, it is expected to improve signal strength in fluorescence observation and imaging, reduce damage to samples by enabling lower light intensities and expand the potential for deep-tissue imaging within biological systems.

- **Significant enhancement of the two-photon absorption cross-section**
  In the NIR region (around 850 nm) suitable for biological applications, the two-photon absorption cross-section of this material has been enhanced from approximately 1000 GM in conventional materials to 5200 GM.

- **Miniaturization of molecular size**
  This material is isotropic and compact in size. Additionally, when the two-photon absorption wavelength falls within the NIR region, which exhibits high tissue penetration, it can be utilized within biological systems.

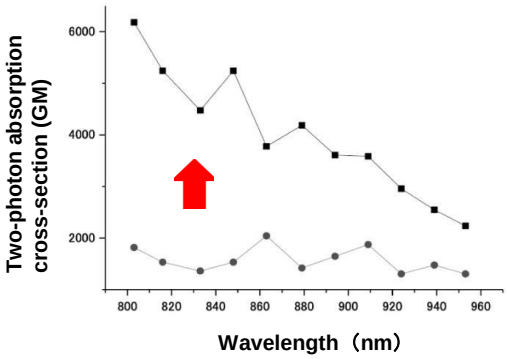

Fig.1: Spectrum of the two-photon absorption cross-section measured with incident light in the NIR region
Significant enhancement has been achieved through theoretical design.

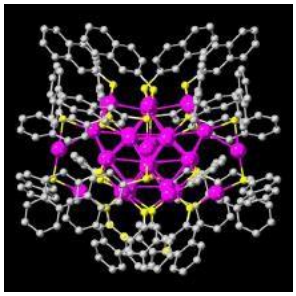

Fig. 2: Molecular structure of the two-photon absorption material
The isotropic metal-based core structure enables the miniaturization of the molecular size.

◆Development Status

- Basic design, as well as the characteristics and functionality as a material, have been confirmed.
- Samples available for testing

◆Applications

- Fluorescence imaging (Multi-lattice excitation laser microscopy)
- Photodynamic therapy
- High-density optical storage
- 3D micro-fabrication

◆Offer

- Patent License
- Option for Patent License
- Joint research
- MTA for sample evaluation

◆Contact

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