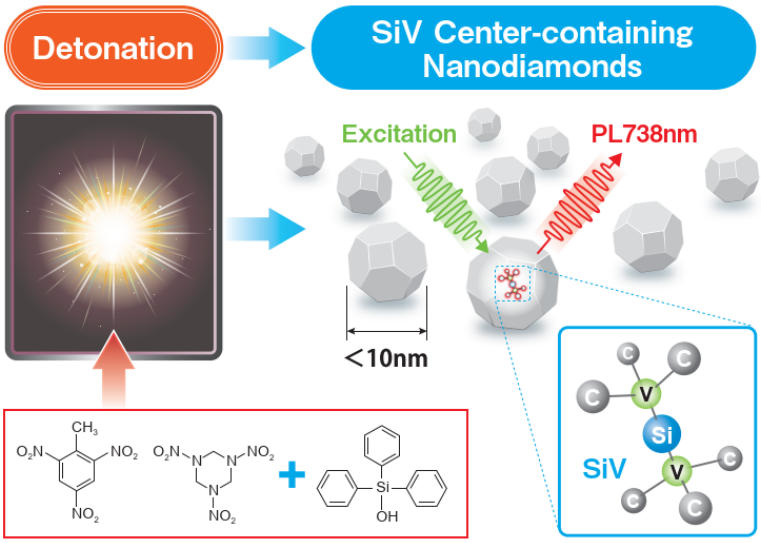
DAICEL CORPORATION

World's First Fluorescent Single-digit Nanometer-sized SiV Nanodiamonds developed by Daicel

Daicel has successfully synthesized the world's first single-digit nanometer-sized fluorescent nanodiamonds incorporating silicon-vacancy colour centers (SiV-ND). SiV-ND is expected to be used in biosensing and bioimaging as a fluorescent probe due to its superior fluorescent properties of stable fluorescence emission at biotissue-permeable wavelength as well as its extremely small size and biocompatibility. Daicel will try to develop applications of SiV-ND.



Straightforward synthesis of SiV center-containing single-digit nanometer nanodiamonds via detonation process

Nanodiamonds may contain unique structures in the diamond lattice which are called color centers. Among the color centers, SiV centers show stable and non-blinking fluorescence with a sharp emission band in the near-infrared region (central wavelength 738 nm) which can be excited by near-infrared light. Near-infrared light can penetrate biological tissues such as skin and blood more efficiently than ultraviolet and visible light and this wavelength area (from 650 to 950 nm) is known as the optical window or therapeutic window.

The synthesis of SiV-NDs has been intensely studied worldwide, but no successful methods for single-digit nanometer SiV-ND had been reported.

Daicel has refined and further developed the detonation method for nanodiamonds synthesis and based on our leading experience and knowledge, we have achieved a successful production method for SiV containing nanodiamonds by detonation.

This achievement was accomplished through collaborative R&D with Osaka University, Kumamoto University, and Kyoto University.
The study was published in Diamond & Related Materials 2021, 112, 108248[※2].

The single-digit nanometer-sized fluorescent nanodiamonds can be expected to be able to obtain accurate position information at the level of cells and protein molecules in internal organs.

※1 Detonation is a method to manufacture nanodiamond particles with a diameter of 4–6 nm at the front of the detonation wave by explosion of TNT/RDX mixture in the span of several microseconds.

※2 For more scientific information, please visit the following URL.
https://doi.org/10.1016/j.diamond.2021.108248

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