Measurement of Nanoscale Physical Enhancement by Materials under X-ray Irradiation

Tech ID: 27331 / UC Case 2016-202-0

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ABSTRACT

Researchers at the University of California, Davis have developed a method to study interactions of high density nanoparticles in solution with high spatial resolution.

FULL DESCRIPTION

Understanding nanoparticle behaviors in solution under X-ray irradiation can help advance the development of drug delivery and theoretical modeling. Currently, there are no viable methods to study the behavior of highly dense nanoparticles dissolved in solution unless the solution is frozen and/or diluted, both of which disturb the natural environment of the nanoparticles.

Researchers at the University of California, Davis have discovered a process called x-ray induced energy transfer (XIET) between nanoparticle donors and acceptors as well as developed a method, based on this process, to study the interactions of high density nanoparticles with high spatial resolution. The long penetration depth of X-rays allows energy transfer between the irradiated nanoparticle donor/acceptor pair to be studied in dense materials embedded in opaque media. The method can also be used to create targeted drug delivery systems by introducing a strong x-ray absorbing donor material that targets a specific host (such as cancer cells in a particular organ) and transfers the absorbed x-ray energy to a drug delivery release vehicle or acceptor. A lethal dose of drugs can be released with a low x-ray dose due to the increased radiation effect (type 2 physical enhancement, T2PE) on the vehicle generated by the donor material. XIET efficiency with T2PE has the potential to improve drug delivery and establish models for more efficient nanomaterial studies.

APPLICATIONS

- Study of nanomaterials in high density
- Observing nanoparticles for new potential drug delivery opportunities
- Targeted irradiation

FEATURES/BENEFITS

- High spatial resolution of nanoparticle interactions
- Efficient enhancements of the interaction of nanomaterial samples in x-rays
- Potential investigation of nanoparticle interaction, such as dimer formation and aggregation

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,531,025	12/20/2022	2016-202
United States Of America	Published Application	20230184752	06/15/2023	2016-202

Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Formation of Polymers on Nanostructures Under X-ray Irradiation
- Nanoparticle Capsules for Magnetically Controlled Color-Changing Materials
- Enhancement of X-Ray Radiation Using Nanomaterials
- X-Ray-Triggered Release of Drugs from Nanoscale Drug Carriers
- Combined Individual Nanomaterial Enhancements for Total X-Ray Enhancement

INVENTORS

- Guo, Ting

OTHER INFORMATION

KEYWORDS

drug delivery, high spatial resolution, irradiation, nanomaterials, nanoparticles, x-ray, x-ray induced energy transfer, T2PE enhancement

CATEGORIZED AS

- **Imaging**
  - Other
- **Materials & Chemicals**
  - Nanomaterials
- **Nanotechnology**
  - Materials

RELATED CASES

2016-202-0

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