

Looking Deeper with Rare Earth Nanoparticles

Description

Under the direction of apl. Prof. Dr. Michael Kumke (RG Physical Chemistry), a user-oriented adaptation of a modular platform for frequency-converting nanoparticles (UCNP) is being worked on, consisting of: i) a biocompatible UCNP (immobilized in solution or on surfaces) as an optical transducer and ii) a portable readout unit (NIR laser diode, detection via smartphone and/or photodiode) for mobile use in life and environmental sciences.

Details

Rapid optical tests in the UV/Vis spectral range are often severely limited for biological or medical samples with intrinsically complex matrices (e.g. wastewater, whole blood, urine). In addition, conventional optical markers (organic dyes, semiconductor quantum dots and



Au nanoparticles) are often unsuitable for use in rapid tests in the medical-biological or environmental analytical field due to their low photostability and possibly high toxicity. Using UCNP as optical transducers avoids these and other disadvantages: no bleaching, no toxicity, high penetration depth of the NIR radiation into the biological matrices, no interference from optical background signals (through a combination of non-excitation using NIR and time-resolved detection). With lanthanides as emission centers in UCNP, very narrow,

characteristic emission bands (also as internal reference) can be used for the development of e.g. competitive binding assays for rapid tests in on-site analytics or for near-patient investigations, especially in combination for a combined multi-analyte platform. With a cost-effective readout unit and implementation as a strip test, UCNP can compete with established tests as uniquely powerful optical transducers, replace them and open up new fields of application.

Methods

- Synthesis of application-specific nanoparticles: optical detection via frequency upconversion; specific surface functionalization for further integration in assays.
- User-oriented method development based on luminescence detection after frequency upconversion ("UCNP platform")

Literature

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Applications

- Biosensor technology
- Medicine
- Environmental analysis

Keywords

- Luminescence
- Upconversion
- Nanoparticles
- Immunoassays
- Rapid tests

Interest in cooperation

- Research-based collaboration
- Contract research
- Industry-sponsored research

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