Sun Innovations, Inc.
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Sun-Innovations.com Nanomaterialstore.com BrandAuthen.com Turbo-Solar.com

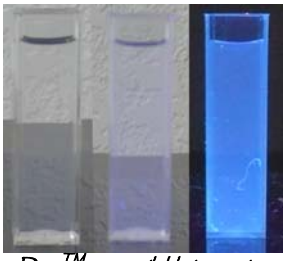
PHOSPHOR DOTS

Sun Innovation's Phosphor Dots™ are a non-toxic alternative to quantum dots. Phosphor Dots combine the best features of both, having a lifetime comparable to quantum dots, while being non-toxic like an organic dye. Our inorganic Phosphor Dots have:

- Higher color purity than quantum dots
- No toxic cadmium or lead
- Lower cost than quantum dots
- Longer life than organic dyes and many quantum dots
- Longer life, more colors than zinc selenide quantum dots
- Comparable absorption: emission efficiency
- Nano-phosphors are available in aqueous dispersions, whereas quantum dots usually require an organic solvent

Phosphor Dots™ shown under UV excitation.

Phosphor Dots™ can be used in traditional quantum dot applications, and are particularly suited to biomedical applications since they lack the inherent toxicity of the quantum dots.

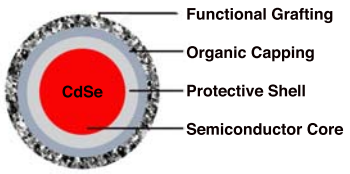


Phosphor Dots™ are available in a variety of colors, and have single or multiple peak emissions instead of band emissions, so they make more unique markers than quantum dots!

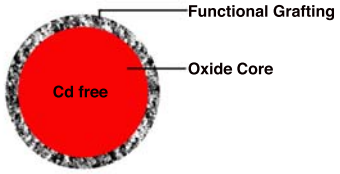
Biomedical applications of quantum dots may include:

1. Bioassay
2. In vitro imaging
3. In vivo imaging
4. Molecular imaging/tracking
5. Cell imaging/tracking
6. Fluorescence spectroscopy
7. Drug markers

Quantum Dot Structure



Phosphor Dot Structure



Advantages of nanoparticle phosphor compared to fluorescent dyes

Conventional dye molecules impose stringent requirements on the optical systems used to make measurements. Their narrow excitation spectrum makes simultaneous excitation difficult in most cases, and their broad emission spectrum with a long tail at red wavelengths introduces spectral cross talk between different detection channels, making quantification of the relative amounts of different probes difficult. Ideal probes for multicolor experiments should emit at spectrally resolvable energies and have a narrow, symmetric emission spectrum, and the whole group of probes should be excitable at a single wavelength. Phosphor Dots™ solve this problem by having disparate emission peaks, and exciting at the same wavelength so it's easy to get reliable data.

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Two problems associated with fluorescence microscopy—cell autofluorescence in the visible spectrum (which can mask signals from labeled molecules) and the requirement of long observation times—have created a need for new probes that emit in the visible range and are more photostable than current organic fluorophores. The long fluorescence lifetime of nanoparticle phosphor-based Phosphor Dots™ enables the use of time-gated detection to separate their signal from that of shorter lived species such as background autofluorescence encountered in cells. Phosphor Dots™ should be able to be observed and tracked over an extended period of time with confocal microscopy, total internal reflection microscopy, or basic wide-field epifluorescence microscopy.

	Old-Fashioned Quantum Dots	Sun Innovation's Phosphor Dots™
Toxicity	Toxic without external shell protection through gradual releasing of cadmium or lead. Could be toxic for long-term applications even being insulated by a shell.	Has no lead or cadmium
Lifetime & durability	Shell layer required to protect core from oxidization and emission quenching, increasing cost and manufacturing complexity.	No risk of oxidization since Phosphor Dots™ are an oxide, and have high emission yield without requiring complex surface treatments. Less manufacturing steps reduces the number of steps in which variation, manufacturing tolerances, or defects can occur.
Solubility	Solubility in water is generally bad without additional chemical modifications to render a hydrophilic surface. Most biological applications are in aqueous system.	Aqueous and solvent dispersion variations are available, making PhosphorDots easy to use.
Size vs. Color	Emission color is size dependent	Color is not size dependent. Particle size can be tailored for different biological applications with same detection technology
UV absorption	Broad UV absorption. Tunable colors emission from 400 nm to 900 nm.	Narrow UV absorption.
Excitation	Simultaneous excitation due to broad UV excitation	Simultaneous excitation due to same host UV absorption.
Synthesis	Synthesis is complicated, such that scaling up production could be difficult.	Simpler synthesis which can be easily scaled up to mass production.
Functioning	More steps such as ligand exchange are required to add functional groups.	No ligand exchange required; easy to add functionalization.
Multiplexing	Limited with broad emission spectrum	10^6 level of multiplexing demonstrated

Upconversion vs. downconversion

NIR excitation probes such as upconversion nanocrystals are excellent for both in vitro and in vivo imaging, because NIR range excitation (750-1000nm) allows deeper light penetration with reduced light scattering, increasing image contrast.

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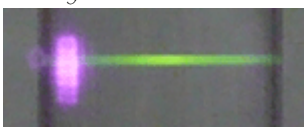
By contrast, if UV excitation is used, biomolecules such as green-fluorescent proteins and other fluorescent organic molecules can be excited by the UV radiation and light up, interfering with image creation and capture. Excitation in NIR induces only a very weak autofluorescence background and avoids photodegradation in biotagging applications, thus simplifying the detection of labeled target molecules and increasing the sensitivity of the method.



IR laser light upconverted with our NaYF4:YbEr Colloid

With high chemical stability, remarkable light penetration depth, and the absence of autofluorescence in biological specimens under infrared excitation, upconversion nanocrystals are ideal for use as luminescent probes in biological labeling and imaging technology, multiplexing, and bio-molecule detection. In terms of when to pick upconversion vs. downconversion, the downconverting particles are several orders of magnitude brighter and are available in more colors, enabling multiplexing, whereas the upconversion particles require a stronger source of illumination such as a laser.

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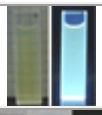
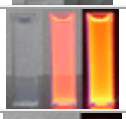
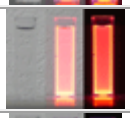
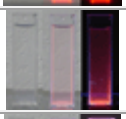
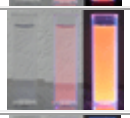
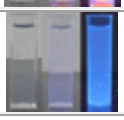
SPECIFICATIONS & PRICING

DESCRIPTION	EXCITE	EMISS	AV SIZE	DISPERSION	PICTURE	CONCENTRATION	COOH Option	STORAGE	ITEM #	PRICE
Cerium Doped Yttrium Aluminum Garnet Colloid	465 nm	545 nm	10 nm	Solvent: 1,4-butanediol		8 mg/ml	Yes	Refrigerate but do not freeze	YAG1001	$200/ml
Dysprosium Doped Yttrium Vanadate Colloid	300 nm	486 & 576 nm	10 nm	Aqueous Colloid with Trace of Citrate		10 mg/ml	Yes	Refrigerate but do not freeze	YVD1001	$70/ml
Dysprosium Doped Yttrium Vanadate Colloid	300 nm	486 & 576 nm	20-50 nm	<0.7 mg/mL PVP		1.0 mg/ml	Yes	Refrigerate but do not freeze	YVD1101	$400/ml
Erbium Doped Yttrium Vanadate Colloid	300 nm	527 & 556 nm	20-50 nm	Aqueous Colloid with Trace of Citrate		10 mg/ml	No	Refrigerate but do not freeze	YVER1004	$250/ml
NaYF4:YbEr Colloid	980 nm	545 nm	25 nm	Hexane		10 mg/ml	No	Refrigerate but do not freeze	YF1001	$300/ml
Europium Doped Yttrium Vanadate Colloid	300 nm	620 nm	20-50 nm	<0.7 mg/mL PVP		1.0 mg/ml	Yes	Refrigerate but do not freeze	YVE1101	$400/ml
Europium Doped Yttrium Vanadate Colloid	350 nm	617 nm	10 nm	Solvent: H2O		10 mg/ml	Yes	Refrigerate but do not freeze	YVE1005	$70/ml
Samarium Doped Yttrium Vanadate Colloid	300 nm	568, 607, & 650 nm	10 nm	Aqueous Colloid with Trace of Citrate		10 mg/ml	Yes	Refrigerate but do not freeze	YVS1001	$70/ml
Samarium Doped Yttrium Vanadate Colloid	300 nm	568, 607, & 650 nm	20-50 nm	<0.7mg/mL PVP		1.0 mg/ml	Yes	Refrigerate but do not freeze	YVS1101	$400/ml
Thulium Doped Yttrium Vanadate Colloid	300 nm	477 nm	20-50 nm	<0.7mg/mL PVP		1.0 mg/ml	Yes	Refrigerate but do not freeze	YVT1101	$400/ml