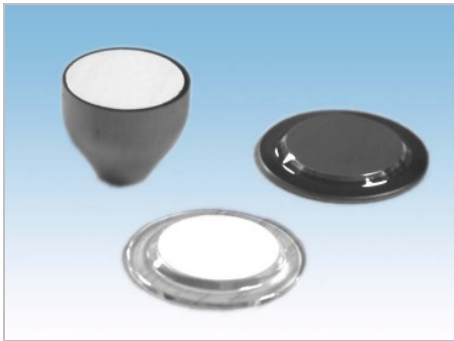


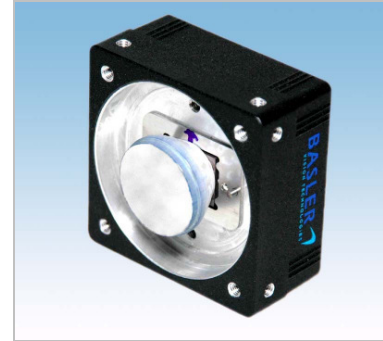
# Phosphor Screens



Taper and glass substrates with phosphor layer



Fibre optic vacuum window vacuum side of vacuum camera



Phosphor coated taper on CCD taper coupled camera

## 2D, visual detection of electrons, charged particles, X-Rays, Neutrons and UV-radiation

### Applications

- Electron Microscopy
- MCP Detector Systems
- X –Ray Imaging
- Powder Diffraction
- SAXS/WAXS
- Protein Crystallography
- UV spectrometer
- Beam profile analysis (UV and IR)
- Neutron tomography

### Features

- Setup due to customer requirements
- P43, P46, P47, P11 and others
- ITO, Chromium, Aluminium, Water Glass coating
- 5 mm - 250 mm diagonal, bigger on request, on any plain and rigid surface (Metal, Glass, Plastic) and on plastic or metal membranes
- Coating of special forms like prisms, tapers; line and area CCD elements

Low Light Cameras Special Purpose Cameras	Short Exposure Cameras Pulse Generators	Fiber Optical Coupling Phosphor Coatings	Detector and Camera Upgrades and Customised Prototyping
Solar Blind & Visible Image Intensifiers	UV & X-Ray Cameras Corona Detection Cameras	Customised Facilities & Equipment	Vacuum & Open MCP Detectors

## Preparation and Features

The phosphor coating is prepared by sedimentation of phosphor grains on a substrate (plain glass, quartz, fibre optic block or taper, CCD chip, prism, metal) usually provided by our customers. Our sedimentation process leads to a very homogeneous layer structure.

To guarantee a homogeneous layer structure, at least 3 to 4 layers of phosphor grains are necessary. The minimum average grain size available is 1 µm. Bigger grains and an increased layer thickness do improve the quantum efficiency while simultaneously efficiency is reduced.

The resolution limit  $R_L$  is defined as the spatial frequency resulting in a modulation transfer function MTF with a value of 3%.  $R_L$  is measured in *linepairs/mm (lp/mm)* and can be approximated as  $R_L = 500/D$  (D = phosphor layer thickness in µm).

The maximum thickness of the phosphor coating is limited technically to ca. 100 µm.

The screens are stable under vacuum conditions and can resist temperatures up to 400°.

As a standard, coatings up to 250 mm can be manufactured. Larger screen sizes are possible on request.

## Standard Phosphor Types

Three criteria allow the choice of the most suitable phosphor type:

- efficiency
- emission spectrum
- luminescence decay time

Type	Composition	Light Emission	Decay Time	
			90 % to 10 %	10 % to 1 %
P43	Gd <sub>2</sub> O <sub>2</sub> S:Tb	Green / 545 nm	1 ms	1,6 ms
P46	Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub> :Ce	yellow green / 530 nm	300 ns	90 µs
P47	Y <sub>2</sub> SiO <sub>5</sub> :Ce,Tb	blue white / 400 nm	100 ns	2,9 µs
P11	ZnS:Ag	Blue / 450 nm	3 ms	37 ms

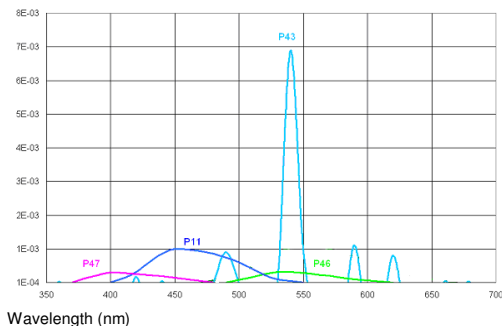
*standard phosphor types*

Apart from that, there is a multitude of UV and x-ray sensitive luminescent phosphors available. For further information, please contact us.

## Efficiency

Efficiency does not only depend on the type of phosphor but also on parameters like grain size, layer thickness, aluminium reflection layer and special manufacturing parameters like thermal processing. It can be reduced by the presence of alkali ions.

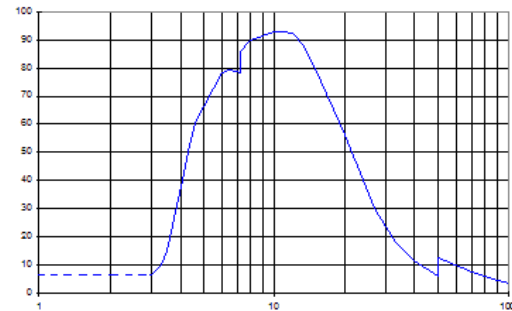
Energy Conversion ((W/nm)/W)



## Phosphor Types for UV and X-Ray Detection

P43 is most recommended for the complete x-ray spectrum and UV radiation of a wavelength ≤ 300 nm. P1 is offered for UV radiation of a wavelength ≤ 220 nm.

Quantum Efficiency (%): P 43 (25 mg/cm<sup>2</sup>, layer thickness: ca. 55 µm)



Photon Energy (keV)

## Options

**ITO Layer** Indium tin oxide (ITO) conducting base coating to reduce electrostatic effects on the screen caused by electrons and ions. The ITO coating is also well known under the name NESA coating. Standard and special conductive parameters can be achieved.

**Electric contact ring** To allow direct electric contact to a phosphor screen, a Electric contact ring can be sputtered on the outer area of the substrate. Chromium Ring (Diameter < 100 mm) / Wolfram Ring (Diameter > 100 mm) This does reduce the area of the phosphor down to the inner diameter of the electric contact ring.

**Aluminium Reflection Layer** To increase light efficiency by up to 100 % and to reduce stray light, it is advantageous for most applications to seal the phosphor coating with an aluminium layer on top of it. As a standard, a 40 nm to 50 nm coating is recommended, but on special request the thickness can be varied between 5 nm and 130 nm. For electrons, an acceleration voltage of 3 kV is required to penetrate the standard aluminium reflection layer. With the use of an aluminium coating, the maximum diameter for the phosphor screen is reduced by 1 mm to allow contact between the aluminium layer and the substrate.

**Water Glass** to improve the mechanic stability of a phosphor screen, water glass can be added during the sedimentation process. A screen manufactured this way can resist a light finger touch. An efficiency decrease of 30 % to 40 % results from this manufacturing process as the density of the phosphor grains in the matrix is reduced.

## Warranty and Storage

Phosphor screens can withstand an electric field of up to 6000 V/mm and can be used under vacuum conditions. Due to their small thickness, the phosphor and Al-layer are very sensitive to any kind of mechanic stress. Even a light touch with a finger can damage the coating, just like their use in a vacuum chamber containing dust or particles. Therefore, we cannot extend our warranty to defects turning up during the operation of our phosphor screens. Prevent phosphor screens from light because it can lead to damages. We recommend to store phosphor screens in darkness under vacuum conditions or in dried nitrogen. Nevertheless, the removal of dust or small particles is possible by simply blowing them off with a jet of dry air or nitrogen.

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