

RHEED Phosphor Standard Screens

APPLICATIONS:

- Beam Detection
- Beam Alignment
- Lens Testing
- Uniformity Testing
- Surface Physics
- **RHEED** (Reflection High-Energy Electron Diffraction) techniques for surface characterization
- UHV Experiments

FEATURES / OPTIONS:

- Phosphor Screens on Glass mounted in 2.75" CF, 4.50" CF, and 6" CF Thin Flanges: Mounted between Viewport and Vacuum Chamber CF Flanges
- High Luminosity Phosphor (P-22 Blue)
- Rugged and UHV Compatible Phosphor Options
- Input 1W/cm² max Power Density
- UHV Phosphor Bakeable to 350°C



Thin Flange RHEED 6.00" CF with conductive glass backed phosphor screen mounted in the flange aperture. Small tabs secure the screen and conduct charge from the screen to the flange and then to ground.

RHEED Phosphor Screens

Kimball Physics RHEED screens are phosphor screens mounted in Thin Flanges that are typically positioned between the Viewport Flange and the vacuum port CF flange.

Kimball Physics Phosphor Screens are made of a high luminosity phosphor (Blue P22- ZnS: Ag). Interestingly, phosphor does not contain phosphorus.

The screens are sensitive to electrons and will emit photons (luminescence) starting at approximately 500 eV with a threshold of 1×10^{-7} A/cm² at 500 eV. The maximum recommended input beam power density is 1 Watt/cm². Two general types of phosphor screens are made by Kimball Physics: Rugged Phosphor Screens and UHV Phosphor Screens.

Rugged Phosphor Screens (Kimball Physics **PHOS-RP22**) are easy to handle and unusually resistant to mechanical damage and rough handling. In these ruggedized screens, phosphor is bonded to either metal or glass backings using a bonding agent which has a low but *non-zero* vapor pressure. Due to the binder, the rugged phosphor is only suitable for vacuum pressures down to 10^{-8} torr (at the lower end of this operating range, some outgassing may be

observed). The rugged screens are particularly suited for use in experimental vacuum systems. Rugged screens have a phosphor thickness of approximately 75 μm . They are fabricated from high luminosity blue phosphor (P-22), available with either stainless steel 304 or glass backings. They are bakeable to 200°C.

UHV Phosphor Screens (Kimball Physics **PHOS-UP22**), with no binder, are compatible with ultra-high vacuums (UHV) better than 1×10^{-8} torr. Although these screens do well in an UHV environment, they are more fragile and require greater care when handling. Since the phosphor coating is delicate, it can be easily damaged from touching the UHV phosphor coating. Also, shock from knocking or dropping the screen may cause the phosphor coating to flake off. Standard UHV screens are shipped with a stainless-steel protective cover. The thickness of the UHV phosphor ranges from 50 μm to 70 μm .

The UHV screens are fabricated from high luminosity blue phosphor (P-22). They are bakeable to 350°C and are available in phosphor screen diameters of 0.50", 0.75", 1.00" and 1.50" for eV Part Plate Mounts and 1.43", 2.83" and 4.20" for Thin Flange Mounts (2.75", 4.50", 6.00" CF respectively). An 8.00" CF Thin Plate Mount is available as an option.

RHEED Phosphor Screen

- Phosphor Screens on *Glass* mounted in 2.75" CF, 4.50" CF, and 6" CF Thin Flanges.
- The Thin Flange Phosphor Screen must be inserted between two CF flanges, such as a Viewport and a vacuum chamber CF port
- The phosphor screen is typically mounted just behind the vacuum chamber viewport.
- Custom sizes and shapes available



RHEED Phosphor Screen	Phosphor Screen Size	Phosphor Type	Mount	Notes Thin Flange Mount
PHOS-RP22GL-CF2.75 P22	1.43"	Rugged	Thin Flange	2.75" CF Thin Flange Mount
PHOS-UP22GL-CF2.75 P22	1.43"	UHV	Thin Flange	2.75" CF Thin Flange Mount
PHOS-RP22GL-CF4.50 P22	2.83"	Rugged	Thin Flange	4.50" CF Thin Flange Mount
PHOS-UP22GL-CF4.50 P22	2.83"	UHV	Thin Flange	4.50" CF Thin Flange Mount
PHOS-RP22GL-CF6.00 P22	4.20"	Rugged	Thin Flange	6.00" CF Thin Flange Mount
PHOS-UP22GL-CF6.00 P22	4.20"	UHV	Thin Flange	6.00" CF Thin Flange Mount
Available as an option	6.20"		Thin Flange	8.00" CF Thin Flange Mount

Notes:

- Phosphor Screens are all mounted on Glass
- 0.4" thick double-sided Multi-CF Thin Flanges
- Thin Flange typically sandwiched between a Viewport Flange and the corresponding system flange
- CF Flange Sizes
 - 2.75" CF Thin Flange Mount: MCF275-ThnFlg-C2-400-ID1500GG
 - 4.50" CF Thin Flange Mount: MCF450-ThnFlg-E2-400-ID2900GG
 - 6.00" CF Thin Flange Mount: MCF600-ThnFlg-F2-400-ID4300GG
 - 8.00" CF Thin Flange Mount: MCF800-ThnFlg-G2-400-ID6300GG

RHEED Phosphor Specifications	
Phosphor Type	ZnS: Ag Type 1330 (P-22 Blue)
Phosphor Screen Type	Rugged, UHV
Phosphor Screen Backing	Conductive Glass
Saturation Threshold	3×10^{-2} Amps/cm ²
Peak Emitted Wavelength	450 nanometers
Maximum Input Power Density	1 Watt/cm ²
Minimum Power Density for Screen Response	5×10^{-5} Watts/cm ²
Max. Bakeout Temperature	Rugged 200°C, UHV 350°C
Notes:	
• Rugged Operating Vacuum Range: vacuum only to 10^{-8} torr, possible outgassing at higher vacuum (smaller pressure range)	
• UHV Operating Vacuum Range: UHV Range, compatible with better than 10^{-8} torr	

Care and Handling Rugged, UHV and RHEED Phosphor Screens

Cautions	<ul style="list-style-type: none"> •Rugged •Rugged RHEED 	Handle with care. Although the phosphor is bonded to SS or glass to resist mechanical shock or accidental touching of the screen, handle the ruggedized screen with reasonable care and do not scrape the phosphor.
	<ul style="list-style-type: none"> •UHV •UHV RHEED 	Handle with care. Use caution when handling the phosphor screen as the coating is extremely delicate. Do not touch the Phosphor Coating or damage may result. Banging or knocking the screen or its mount on a hard surface could cause phosphor to flake off.
Shipping Protection	•RHEED	For protection of the RHEED Phosphor Screen, it is shipped with a Plexiglass cover and a steel base. The cover should be removed by a qualified technician wearing clean room gloves. Do not touch or knock the phosphor surface while removing the cover. <ul style="list-style-type: none"> • Remove the 12-point bolts • Carefully lift off the Plexiglas cover; it will expose the fragile phosphor surface • Holding the edge of the flange, remove phosphor screen with its flange from the steel base. Save the cover and base for shipping or storage.
Grounding	•All phosphor screens	After installation, ensure that the screen is properly grounded.
Maximum Input Power Density	<ul style="list-style-type: none"> •Rugged •UHV •RHEED 	1 Watt/cm ² Caution: Exceeding 1 Watt/cm ² input power may damage the phosphor coating. To preserve screen brightness, it is advisable to use the lowest power density that provides a clear spot. Input Power Density = $\frac{\text{Beam Current} \times \text{Beam Energy}}{\text{Spot Size (area)}}$

Phosphor Screen Notes

- 1) Using the phosphor screens at electron energies below the first unity-secondary-emission crossover point may cause the screen to charge up to electron cathode potential, at which point the screen temporarily goes out.
- 2) When using the phosphor screen, input power density should not exceed 1 Watt/cm², or the phosphor coating may be damaged. To preserve screen brightness, it is advisable to use the lowest beam power density that provides a clear spot. Normal usage will result in gradual browning of the screen.
- 3) Ruggedized screens are bakeable up to 200°C; UHV screens are bakeable up to 350°C.
- 4) Larger screens, mounted in either six- or eight-inch viewports are also available as an option. The diameter of a screen for a six-inch viewport would be 4.2 inch and the diameter of a screen for a eight inch viewport would be 6.2 inch. These larger phosphor screens can be deposited on leaded glass if required.
- 5) Rugged screens on stainless steel can, as an option, be deposited directly on the eV square plate.
- 6) UHV screens on stainless steel are deposited on a round stainless steel plate that is affixed to the square mounting plate by four equally spaced tabs spot-welded to the square mounting plate and to the underside of the round (phosphor- coated) plate.
- 7) Standard phosphor screens deposited on conductive glass (both Rugged and UHV) are held between two stainless steel plates, within a center hole, by four equally spaced tabs on both sides of the screen. The tabs, which are spot-welded to the stainless steel plates, also serve to bleed off charge from the screens.

References

For more information about Kimball Physics Detectors, please visit our website at:
Kimball Physics Detectors

Other References

Thin Mounting Flanges
eV Parts

Notes:

1. **Cautions when directly attaching to MCF Chambers:**
 - Silver Plated Bolts or Equivalent Lubrication must be used
 - Please measure the hole depth and other flange / copper ring /part thicknesses
 - Choose a correct bolt length such that the bolt doesn't bottom in the tapped hole prior to tightening the structure.
2. Specifications Subject to Change Without Notice.
3. DE Altobelli, DT Taylor 1/25/2023

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