Opto-Physics Infrared Polarizers
GS57500 Series

User Manual

2I-57500-3

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CONTENTS - USER MANUAL

1. Introduction

Thank you for purchasing a Specac Product.

Polarizers are commonly used to polarize radiation from unpolarized sources, attenuated radiation from polarized sources, or act as polarizing beamsplitters. Specac offers a range of holographic wire polarizers laid onto a transmitting substrate material for use in the 1 - 35µm (10000cm^{-1} - 285cm^{-1}) spectral range.

The Opto-Physics polarizers that are provided as the GS57500 Series range of polarizers available from Specac consist of a particular substrate material that has a polarized grid photo-etched onto one of the surfaces of the circular substrate material. Each polarizer substrate material option has a polarizing grid of 2500 lines per mm onto a substrate of 22mm diameter and 2mm thickness or 42mm diameter and 4mm thickness.

Specifically for the GS57500 Series range of Opto-Physics polarizers, the substrate material with a polarizer grid is supplied permanently mounted in a black coloured, anodized aluminium ring mount of two different diameters and thicknesses – 25mm O.D and 5mm thick or 50mm O.D. and 6mm thick. The 25mm O.D. polarizers have a clear aperture (C.A.) of 18mm diameter and the 50mm O.D. polarizers have a C.A. of 34mm.

The part numbers and choice of substrate materials available for the GS 57500 Series polarizers are:

P/N GS57500 for KRS-5 (25mm O.D. – spectral transmission range 2 - 35µm).
P/N GS57501 for CaF_2 (25mm O.D. – spectral transmission range 1 - 10µm).
P/N GS57502 for BaF_2 (25mm O.D. – spectral transmission range 1 – 12µm).
P/N GS57503 for ZnSe (25mm O.D. – spectral transmission range 1 - 15µm).
P/N GS57504 for KRS-5 (50mm O.D. – spectral transmission range 2 - 35µm).
P/N GS57505 for CaF_2 (50mm O.D. – spectral transmission range 1 - 10µm).
P/N GS57506 for BaF_2 (50mm O.D. – spectral transmission range 1 - 12µm).
P/N GS57507 for ZnSe (50mm O.D. – spectral transmission range 1 - 15µm).

This user manual instructs on how to unpack and handle carefully the GS57500 Series polarizer supplied and also informs how the grid pattern of the polarizer (2500 parallel lines per mm) is aligned in relation to the anodized aluminium mount.

2. Safety Considerations

When handling a polarizer correctly as advised, there are inherently minimal safety concerns to follow involved with their use.

Despite the general safety precaution to avoid touching any of the substrate materials and photo-etched polarizer grid where at all possible, depending upon **which** particular substrate material type for the GS57500 Series polarizer that has been supplied and is to be used, there are certain safety precautions to observe associated with the substrate material.

Related to the particular polarizer substrate material type you have received or are using for the GS57500 Series polarizer, please refer to the relevant substrate material safety and handling information in Section 7 of this instruction manual.

3. Unpacking and Checklist

The GS57500 Series polarizer for either diameter size is supplied in its own container of two plastic circular covers held together by plastic tape wrapped around the cover circumferences.

On receipt please check that the following items have been supplied.

- A 25mm O.D. GS57500 Series polarizer of your choice in its own container. (Ordered as P/N GS57500, GS57501, GS57502, or GS57503).
- A 50mm O.D. GS57500 Series polarizer of your choice in its own container. (Ordered as P/N GS57504, GS57505, GS57506, or GS57507).

Caution!

*When removing the items from their packing be especially careful handling the GS57500 Series polarizer. The polarizer grid is very fragile and you **must** avoid contact with the polarizer substrate surface, otherwise the grid could be irreparably damaged. It is advisable to store the GS57500 Series polarizer in its original packing container when not being used.*

4. Instructions for Use

All of the GS57500 Series polarizers are supplied permanently fitted into a black coloured, anodized aluminium ring mount (**1**).

Note: *On no account is the polarizer substrate (**2**) to be removed from the anodized aluminium ring mount (**1**).*

Polarizer Grid on GS57500 Series Polarizers

As mentioned in Section 2, when removing the GS57500 Series polarizer from its packing, be very careful in its handling. The polarizer components (**1**) and (**2**) are held between two plastic lens cap covers with plastic tape wrapped around the circumference to seal the cap covers together. Carefully peel the tape away to gain access to polarizer assembly (**1**) and (**2**). (See **Fig 1.**)

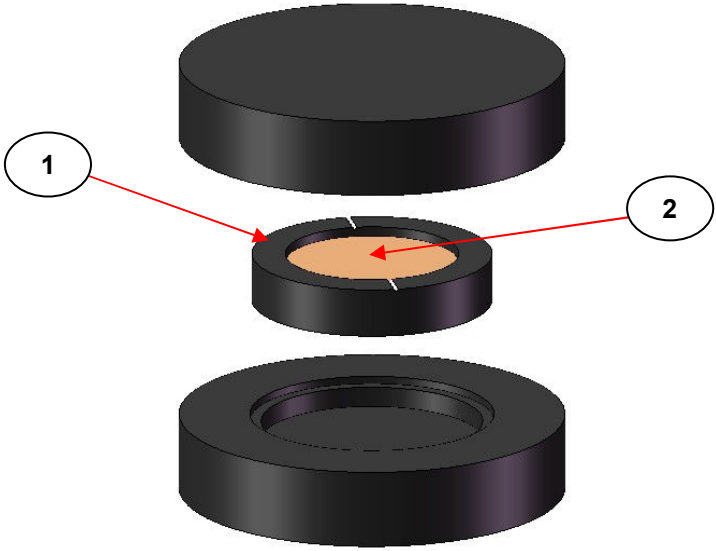

Fig 1. GS57500 Series Polarizer as Supplied in Packing Covers

The polarizer grid is deposited onto one surface of the substrate (**2**) material. The polarized grid surface is on the same side of the polarizer ring mount that carries the two engraved marks (**3**). (See **Fig 2.)**

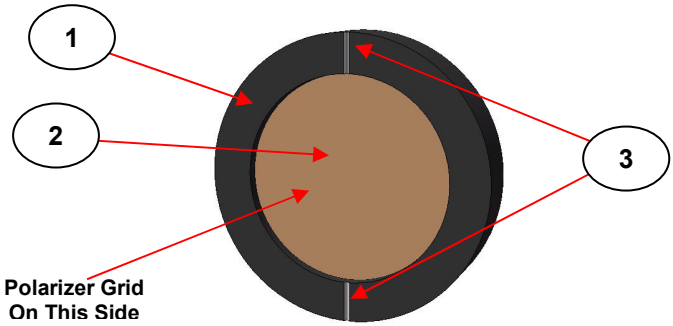

Fig 2. Engraved Marks on Ring Mount for GS57500 Series Polarizers

To determine the polarizer grid line pattern (2500 lines per mm) that has been deposited onto the substrate (**2**), if the one of the grooves (**3**) is positioned at a 12 O'clock position, the grid lines of the polarizer run parallel to the diameter of the substrate (**2**) that passes through **both** grooves (**3**) at the 12 and 6 O'clock positions on the ring mount (**1**). (See **Fig 3.**)

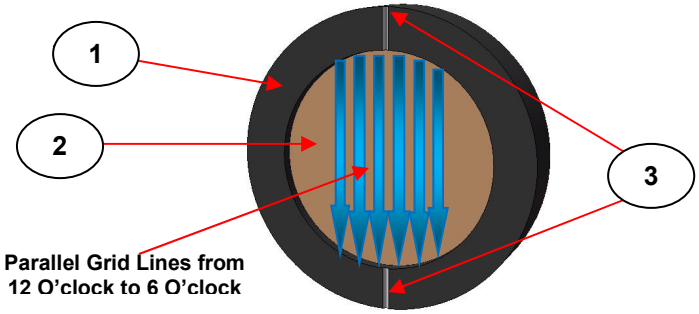

Fig 3. Polarizer Grid Line Orientation of Parallel Lines on the Substrate Surface of the GS57500 Polarizer

Using a GS57500 Series Polarizer

The GS57500 Series polarizers being provided in 25mm and 50mm diameter sizes allows them to be mounted easily and readily in a wide variety of different holders for use.

For the actual installation of a polarizer into a beam path of a source of light to sample and then to a detector, it does not matter if the polarizer is positioned before light has interacted with a sample (between the source and sample) or after interaction (between the sample and detector). The result of discriminating and measurement for a particular plane of polarized light from an angular setting of the polarizing grid deposited on the substrate material, when a polarizer is introduced into the beam passage sequence, is the same.

Note: *It is advisable to wear gloves when handling any polarizer to avoid getting fingermarks on the polarizer substrate material (**2**) and to prevent any damage to the polarizer grid.*

General Cautions and Care of the Polarizer

The GS57500 Series polarizer grid consists essentially of very fine aluminium lines being deposited on a substrate material and they can very easily be damaged due to incorrect handling of the polarizer.

Should the polarizer grid be affected in any way by finger marks, dust or dirt, it is very likely that the performance of the polarizer will be seriously impaired, and in certain cases the damage that has been sustained is irreparable. A new polarizer will be required.

Hence, some general rules to follow to care for your polarizer are:-

- Do not touch, rub or abrade the polarizing grid or substrate surface.
- Do not wash the polarizing grid with organic solvents.
- Any dust that may be present on either surface of the substrate material should be gently blown clear using an air or nitrogen line.
- Always store the polarizer in its original packing container when not being used.

5. Legend – Bubble Part Number Identification

(**1**) Anodized aluminium ring mount of GS57500 Series polarizers.
(**2**) Polarizer substrate material.
(**3**) Polarizer orientation groove mark on ring mount.

6. Parts for GS57500 Series Polarizers

Polarizers (25mm O.D. 5mm thick, 18mm C.A.)

P/N GS57500 KRS-5 Opto-Physics polarizer.
P/N GS57501 CaF_2 Opto-Physics polarizer.
P/N GS57502 BaF_2 Opto-Physics polarizer.
P/N GS57503 ZnSe Opto-Physics polarizer.

Polarizers (50mm O.D. 6mm thick, 34mm C.A.)

P/N GS57504 KRS-5 Opto-Physics polarizer.
P/N GS57505 CaF_2 Opto-Physics polarizer.
P/N GS57506 BaF_2 Opto-Physics polarizer.
P/N GS57507 ZnSe Opto-Physics polarizer.

7. Substrate Material Safety Information

KRS-5 Substrate Material – P/N's GS57500, GS57504

General
Synonyms: Mixture of Thallium Bromide and Thallium Iodide (typically 58% Iodide content).
Very toxic red coloured soft crystalline powder when fused together as a solid can be used as a transmission window material or as a crystal material for attenuated total reflectance (ATR) FTIR spectroscopy.
Slightly soluble in water, soluble in bases, but not soluble in acids. Not hygroscopic.
Organic solvents have no effect.
Soft window material and easily deformed.
Molecular formula: $TlBr_{0.4}I_{0.6}$

Physical Data
Appearance: Red, soft crystals, granular powder or red coloured window material
Melting point: 414°C
Solubility in water: 36g/100g at 0°C.
Hardness: 40 Kg/mm^2.
Refractive Index: 2.38 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 17,000 to 250 cm-1 (wavenumbers).

Stability
Stable.

Toxicology

Very toxic if small amounts are inhaled or swallowed. May be fatal if swallowed. May be absorbed through the skin. Irritant.

Personal Protection
Always wear safety spectacles and gloves when handling the powder or window material.
Allow for good ventilation. If material is machined, polished or ground, precautions must be taken against inhalation of dust.

Storage
Keep powder or windows stored in a cool, dry container, with appropriate safety labelling.

CaF_2 Substrate Material – P/N's GS57501, GS57505

General
Known as Calcium Fluoride, Calcium Difluoride, Fluorspar or Irtran 3.
When powder is fused together, is used as a transmission window material.
Insoluble in water, resists most acids and alkalis. Is soluble in ammonium salts.
Its high mechanical strength makes it particularly useful for high pressure work.
Brittle material sensitive to mechanical and thermal shock. Does not fog.
Molecular formula: CaF2.
Chemical Abstracts Service (CAS) No: 7789-75-5.

Physical Data
Appearance: Odourless, white or colourless crystalline solid.
Melting point: 1360°C.
Boiling point: 2500°C.
Solubility in water: 0.0017g/100g at 0°C.
Hardness: 158 Kg/mm^2.
Refractive Index: 1.40 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 77,000 * to 900 cm-1 (wavenumbers).

Stability
Stable.
Incompatible with acids.

Toxicology

Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

Personal Protection
Always wear safety spectacles and gloves when handling the powder or window material.
Allow for adequate ventilation.

Storage
Keep powder or windows stored in a cool, dry container.

(* UV Grade material required for this range limit.)

BaF_2 Substrate Material – P/N's GS57502, GS57506

General
Synonyms: Barium Difluoride.
When powder is fused together, is used as a transmission window material.
Very slightly soluble in water, soluble in acids and ammonium chloride. Good resistance to fluorine and fluorides. Does not fog.
Its high mechanical strength makes it particularly useful for high pressure work.
Brittle material - very sensitive to mechanical and thermal shock.
Molecular formula: BaF2.
Chemical Abstracts Service (CAS) No: 7787-32-8.

Physical Data
Appearance: Odourless, white or colourless crystalline solid.
Melting point: 1280°C.
Boiling point: 2137°C.
Solubility in water: 0.17g/100g at 0°C.
Hardness: 82 Kg/mm^2.
Refractive Index: 1.45 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 66,666 * to 800 cm-1 (wavenumbers).

Stability
Stable.
Incompatible with acids.

Toxicology

Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

Personal Protection
Always wear safety spectacles and gloves when handling the powder or window material.
Allow for adequate ventilation.

Storage
Keep powder or windows stored in a cool, dry container.

(* UV Grade material required for this range limit.)

ZnSe Substrate Material – P/N's GS57503, GS57507

General
Toxic and hard yellow coloured crystalline powder when fused together as a solid can be used as a transmission window material or as a crystal material for attenuated total reflectance (ATR) FTIR spectroscopy.
Insoluble in water, but attacked by strong acids and bases. (pH range 4 to 11 tolerant).
Organic solvents have no effect.
Fairly brittle as a window material and sensitive to thermal and mechanical shock.
Molecular formula: ZnSe
Chemical Abstracts Service (CAS) No: 1315-09-9.

Physical Data
Appearance: Yellow crystals, granular powder or amber coloured window material
Melting point: 1515°C at 1.8 atmospheres. (26.5psi)
Solubility in water: 0g/100g at 0°C.
Hardness: 120 Kg/mm^2.
Refractive Index: 2.43 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 20,000 to 500 cm-1 (wavenumbers).

Stability
Stable.
Reacts with acids to give highly toxic hydrogen selenide. May be air and moisture sensitive. Incompatible with strong acids, strong bases and strong oxidising agents.

Toxicology

Toxic if small amounts are inhaled or swallowed. In stomach toxic hydrogen selenide (H2Se) is liberated. Skin and eye irritant. Danger of cumulative effects from frequent handling without protection.

Personal Protection
Always wear safety spectacles and gloves when handling the powder or window material.
Allow for good ventilation.

Storage
Keep powder or windows stored in a cool, dry container, with appropriate safety labelling.

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