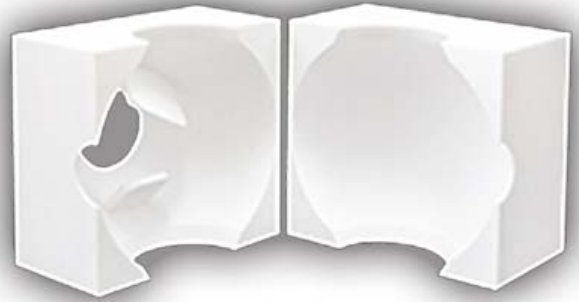


ODM98 Diffuse Reflecting Coating Synthetic Material

OP.DI.MA. is a special processed synthetic material which works as a translucent reflector. This means that radiation will enter into the material and reflect from many interfaces within the material itself. This results in a nearly perfect diffuse reflection. A side effect of volume reflection is a variation in transit times of the reflected radiation within the material. This variation in transit eliminates speckling effects associated with coherent radiation.

10 mm thick ODM98 provides a reflectance of up to 98.5% in the visible spectrum and a minimum reflectance of 93% within the wavelength range from 250 nm to 2.5 μm . Other properties of OP.DI.MA. include temperature stability up to 280° C, insolubility in water and resistance to UV degradation.

The surface of the material must be machined to obtain an optical finish without gloss effects. It can be re-machined and cleaned prolonging its operational life. Of course, these outstanding properties are accompanied by some limitations: the material can only be manufactured in block or plate form. This generally necessitates performing cutting operations to shape the material to the desired form. As a translucent reflector, the level of reflection depends on the material thickness. The material can not be applied as a coating. So successful use of ODM requires correct implementation and processing strategy.



1. Reflectance of ≥ 10 mm thick Material:

ODM98 is the purest form of OP.DI.MA. offering the highest possible reflectance within the UV-VIS-NIR wavelength range. In ≥ 10 mm thickness a reflectance of 98 +/- 1% is specified in the visible wavelength range from 400 to 800 nm, whereas a minimum reflectance of 93 % is specified within the entire useful wavelength range from 250 nm to 2.5 μ m. See picture 1 and 2 in the graphical specifications.

2. Reflectance of < 10 mm thick Material:

Translucent reflectors reflect light within the material itself. As a result reflectance is thickness dependent. The thinner the material the lower the reflectance allowing more light to pass through the material (see picture 3 in the graphical specifications). For visible light about 70% reflectance is achieved within the first few hundred micrometers of the material. In some applications the recommended 10 mm thick material cannot be used.

Typical examples where 10mm thick material cannot be used are:

- Reflectors made out of ODM98 foils (thin sheets)
- Machined knife-edge integrating sphere ports
- Diffuser windows

3. Surface Influence on Reflectance:

Reflectance level and diffuse reflectance quality depends on material properties, surface conditions and thickness. Any mechanical abrasion of the surface may result in gloss reflections. Also, absorption of volatile substances alters ODM98's reflective behavior. The adverse optical effects caused by surface contamination like grease (fingerprints) or oil are similar to those of other optical components. If the surface cannot be cleaned using distilled water (without pressure), material must be removed.

4. Ageing Characteristics:

ODM98's optical stability under exposure to high power optical radiation irradiation is one deciding factor for its selection over other reflectance materials. Its fundamental long term stability results from the basic material itself, in association with a careful manufacturing process employing ISO 9001 certified Quality Management and has no real limitations. Quantitative data on UV resistance is only provisional, because of the many factors which actively influence practical applications. One test, as shown in the adjacent graph (picture 4 in the graphical specifications) shows an ageing test on an ODM98 reflection standard with a 420 W halogen-metal vapor lamp operating in the 250 to 400 nm wavelength range. Field reports involving applications using high-powered laser cavities and on-line fluorescence sensors confirm minimal ageing under exposure to UV.

5. Maximum Permissible Radiation Flux Density:

The maximum permissible radiation flux density for ODM98 can, like many other parameters, only be described through particular examples.

In a series of tests an ODM98 reflection standard was exposed to pulsed laser radiation. The wavelength of the laser was 1064 nm, the focus diameter 200 μ m, the pulse length 200 μ s, the repetition rate 25 Hz and the mean power was 21 W. The peak power of 4.2 kW resulting from this, representing a radiation flux density of 13.3 GW/m² did not yield any detectable alterations. Surface impurities were removed by the laser itself at the start of the test series.

6. Temperature Characteristic:

ODM98 is capable of operating in high temperatures up to 280° C. This allows the material to be used in intense applications environments. Investigations of the reflection factor dependency on operating temperature indicate that it is highly stable.

Picture 5 in the graphical specifications shows that the reflection factor during temperature cycles from room temperature up to +100° C remains stable. In fact the measured deviation was within the repetition accuracy of the

experimental set-up used. Using temperature cycles up to +170° C constant change in the reflectance of about 1% has been recorded. This is due to tempering processes occurring within the material at high operation temperatures. Of course, at increasing temperatures, reduction in mechanical stability must be considered.

7. Machining:

Machining OP.DI.MA. is not difficult for those with some experience with processing plastics. All machining methods such as lathe work, drilling, sawing, milling, etc., are possible. See Block Material for Customer Processing for more information.

8. Cleaning:

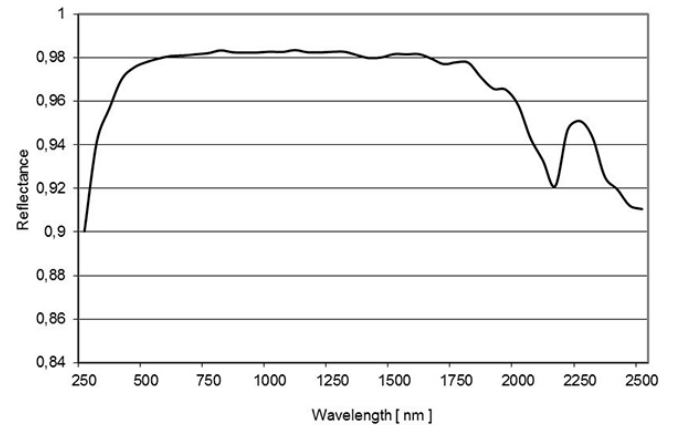
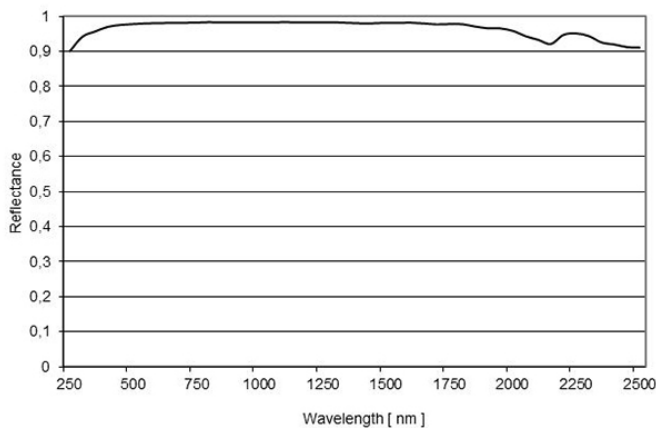
ODM98 is chemically inert, and is stable against acids, bases and other organic solvents. A special manufacturing process also gives it high mechanical stability. These properties mean that dust, for instance, can be removed with paper tissues (lint-free, no pressure). Other impurities can be removed with water/alcohol mixtures or with methylene chloride or hexane (hexane is appropriate for organic impurities). When cleaning with solvents, these penetrate into the micro-porous (amorphous) structure of the plastic. After cleaning, which can, for instance, be carried out using solvent-soaked paper tissues, the plastic must be "baked" at a temperature near the solvent's boiling point. Scratches and "polished" areas which diminish the reflective properties can be removed by removing the top layer with fine-grained abrasive paper. It is recommended that calibrated reflection standards be recalibrated after cleaning.

Specifications

ODM98 Material Specifications:		
Density	g/cm ³	1.5
Hardness	Shore D	30-40
Max. Operating Temp.	°C	280
Coefficient of Thermal Expansion		75-150 *10 ⁻⁶
Thermal Conductivity	kcal/mh°C	0.2
Resistivity (DIN 53482)	Wcm	10 ¹⁶
Water Solubility*		insoluble
Resistance to Chemicals		high**
*Material is porous, reflectance properties will change with absorption of liquids		
**A list of materials ODM98 is resistant to is available		

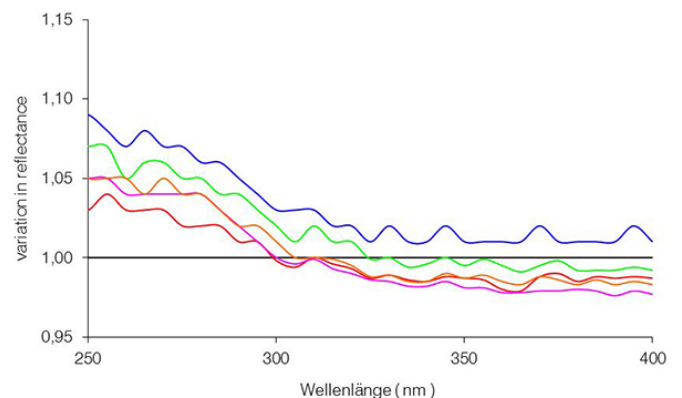
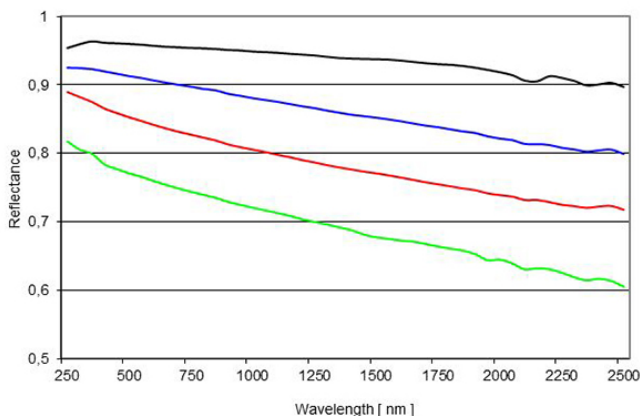
ODM98 Reflectance Specifications		
Reflectance % @ 555 nm	Wavelength Range 400-800 nm	Wavelength Range 250-2500 nm
98	98 % +/- 1 %	min. 93 %

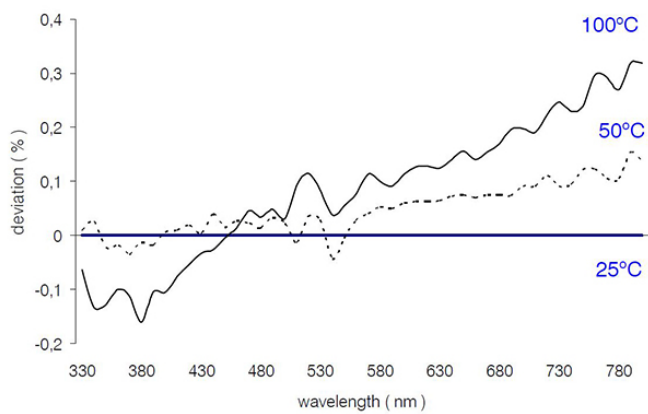
Spectral Reflectance



Typical Spectral Reflectance of ODM98 (0-100%)

Typical Spectral Reflectance of ODM98 (84-100%)



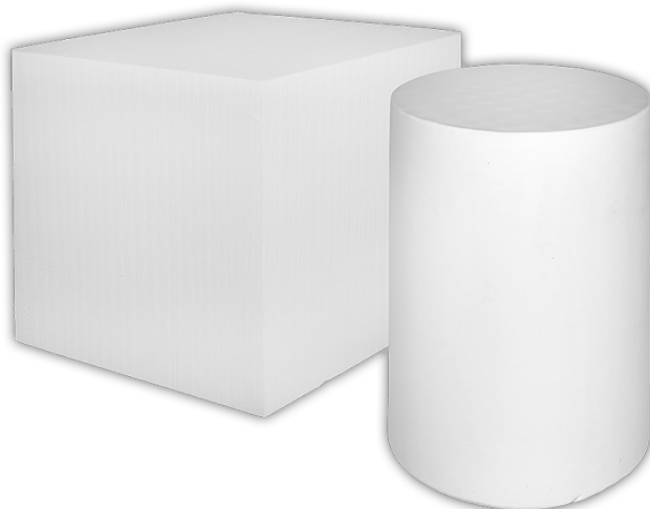


Typical change in spectral reflectance vs. temperature. The spectral reflection factor at 25° C is represented by the reference line.

ODM98-B Raw Block Material

Raw ODM98 blocks can be used for machining small size integrating sphere inserts, integrating sphere baffles, tubes, laser cavities, and other high reflectance parts. For cost effectiveness the size of the raw block should be as close as possible to the maximum dimensions of the final product. Custom size blocks can be ordered for larger quantity OEM orders. Custom size blocks are not available for prototypes or in small quantities. For small quantity orders Gigahertz-Optik stocks different size standard blocks for fast delivery. Contact our sales department to discuss your raw block requirements.

Note: Raw block surfaces must be machined to an optical finish.



ODM98-P Raw Plates

Raw ODM98 plates can be used for machining flat reflectance standards and small size components like integrating sphere baffles and other optical components requiring high reflectance. For cost effectiveness the size of the raw plate should be as close as possible to the maximum dimensions of the final product. Custom size plates can be ordered for larger quantity OEM orders. Custom size plates are not available for prototypes or in small quantities. For small quantity orders Gigahertz-Optik stocks different size standard plates for fast delivery. Contact our sales department to discuss your raw block requirements.

Note: Raw plates surfaces must be machined to an optical finish.



ODM98-F Foil Material

ODM98 foil or thin flexible sheet material can be used as light source diffuse reflectors as diffuse transmitting windows and in many different applications. Gigahertz-Optik stocks ODM98 foils in different thicknesses and different widths supplied in minimum 1m length. Custom thicknesses and widths in OEM quantities are available on request. Contact our sales department to discuss your foil requirements.

Note: The manufacturing and cutting process does not allow raw foil to be supplied with an optical finish surface.



ODM98 Machined Plates, Machined Discs and Reflectance Standards

ODM98 is commonly used as reflectance standards (flat surface) for the calibration of:

- Spectrophotometers
- Imaging System Pixel Uniformity
- Reflectance Meters
- Surface Color Meters

ODM98-MP are square plates with surfaces machined to a flat optical finish. Gigahertz-Optik GmbH stocks different size machined plates at a thickness of 10.5mm. For OEM applications custom sizes, shapes and thicknesses are available.

ODM98-MPT are square plates with one surface machined to a flat optical finish and with double-sided adhesive tape on the other side providing a simple means of mounting the plate. Gigahertz-Optik GmbH stocks different sizes of taped machined plates. For OEM applications custom sizes, shapes and thicknesses are supplied.

ODM98-MD are plates in disc shape with surfaces machined to a flat optical finish. Gigahertz-Optik GmbH stocks different sizes of 10.5mm thick discs. For OEM applications custom sizes, shapes and thicknesses are supplied.

BN-R98 Reflectance Standards are ODM98-MP plates or ODM98-MD discs supplied in a protective housing with removable cover. Gigahertz-Optik GmbH stocks different sizes of BN-R98 reflectance standards in disc and plate shape. All standards can be supplied with optional spectral reflectance calibration from 250 nm to 2500 nm in 50nm steps. Calibration is done with a double-beam spectrophotometer in 8/d measurement geometry using reflectance standards traceable to national calibration laboratories. For OEM applications custom sizes, shapes and housings are available.



Gigahertz-Optik GmbH offers full custom design and machining service for its ODM98 material. These services include 3D CAD design work, CNC machine programming using our own design or customer generated design and CNC machining. Small quantities are made using stock raw block or raw plate materials. OEM quantities include custom size raw material for machining time and material cost saving.

ODM98 machining processes include:

- Cutting of machined plates
- 5-axis CNC milling of plates and three dimensional parts
- 2-axis CNC milling of large size plates
- CNC lathe work
- CNC drilling
- Tapping

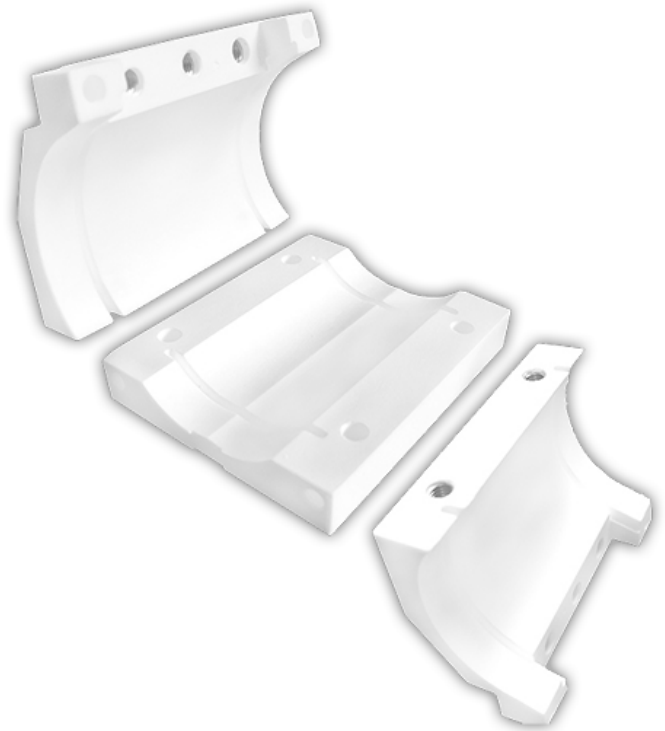
Typical examples of custom design products include:

- Custom size and shape reflectance standards
- 2D reflectors for high power density lamps
- 2D reflectors with adhesive tape
- 3D machined cavities
- 3D machined reflectance standards for spectrophotometer
- Custom size and shaped integrating sphere inserts
- Custom prism shape mounts for diamonds and small parts inspection

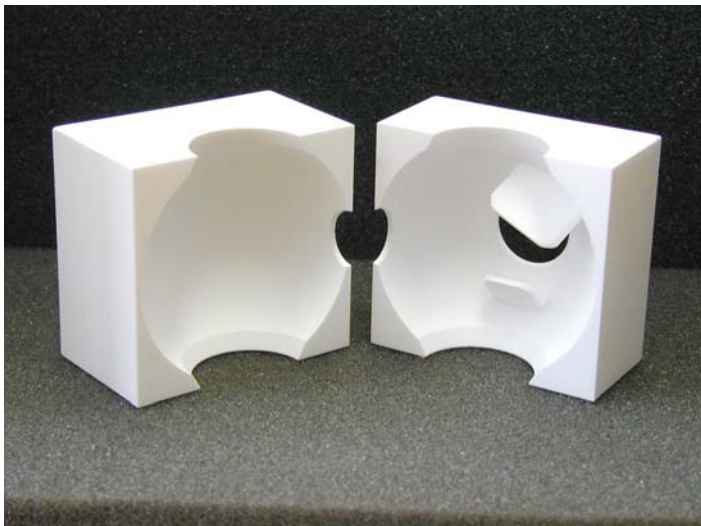
Custom design assembly service:

Gigahertz-Optik GmbH offers custom design assembly service including custom design housing and device assembly. CNC machining of plastic and aluminum as well as anodizing and painting of metal components is part of the service.

Please contact our sales for help in the selection of the best process for your requirements!



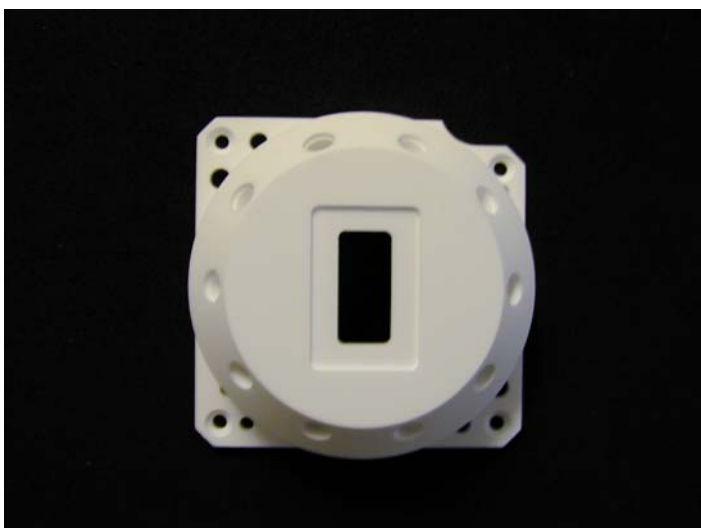
Product Pictures



Picture 1: Custom Design 4" Integrating Sphere Insert with Integrated Baffles



Picture 2: Custom design Prism Container for Diamond and Small Parts Inspection



Picture 3: Custom design Integrating Sphere Source Insert



Picture 4: Flow Water Reactor with ODM98 Foil Reflector for Diffuse Light Stimulation



Picture 5: Parts of 3D Formed Cavity



Picture 6: Custom Design Integrating Spheres in 2", 1.5" and 1" Sizes



Picture 7: Stretched Integrating Sphere for Side Emitting Fibers with Protection Insert



Picture 8: Custom Design 10" Integrating Sphere with Nikon Bayonet Source Mount Adapter



Picture 9: 10x10mm Cuvette Sample Holder

Purchasing Information

ODM98-B Raw Block Material

Model	Item No.	Dimensions
ODM98-B01	100711	200 x 200 x 200 mm
ODM98-B02	100712	120 x 120 x 250 mm
ODM98-B03	100713	120 x 120 x 120 mm
ODM98-B04	100714	65 x 65 x 500 mm
ODM98-B05	100715	65 x 65 x 245 mm
ODM98-B06	100716	65 x 65 x 120 mm
ODM98-B07	100717	D170 x 190mm
ODM98-B08	101223	76 x 76 x 250 mm
ODM98-B13	101084	D52 x 250 mm

ODM98-B Raw Plate Material

Model	Item No.	Dimensions
ODM98-P01	101224	560 x 260 x 12 mm
ODM98-P02	101225	305 x 305 x 12 mm
ODM98-P03	101226	260 x 260 x12 mm
ODM98-P04	101227	135 x 135 x 12 mm
ODM98-P05	101228	55 x 55 x 12 mm

ODM98-B Raw Foil Material

Model	Item No.	Dimensions
ODM98-F01	100779	1.5 x 300 x 1000 mm*
ODM98-F02	100720	0.2 x 105 x 1000 mm*
ODM98-F03	100989	0.5 x 105 x 1000 mm*

*) minimum length cut from roll

Gigahertz-Optik

An der Kälberweide 12
D-82299 Türkenfeld

Telefon: +49 (0) 8193 93700 - 0
Fax: +49 (0) 8193 93700 - 50

[email: info@gigahertz-optik.de](mailto:info@gigahertz-optik.de)



Made in Germany

