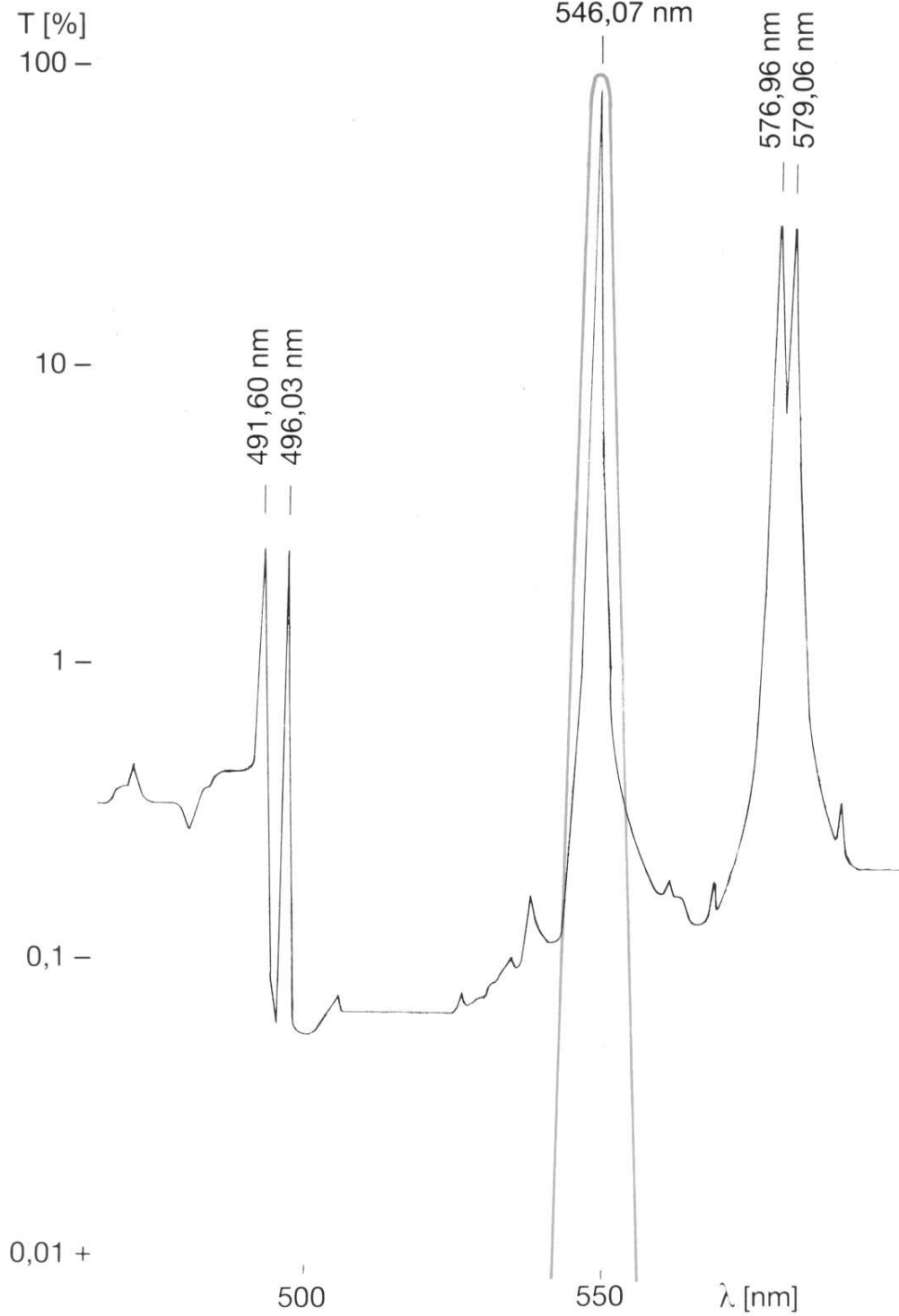


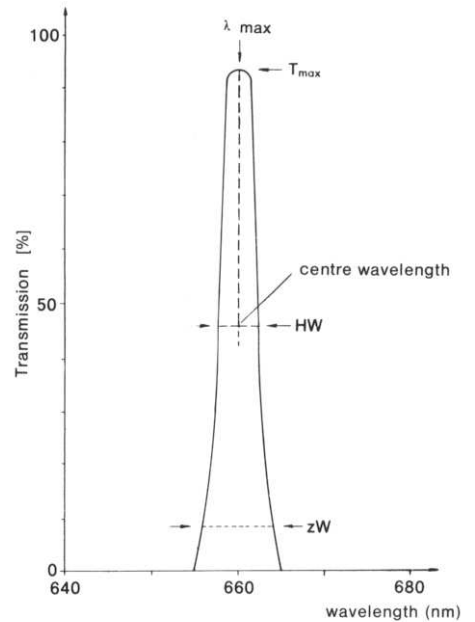
Dielectric Interference Filters

Area 302 - 1600 nm



Definitions:

- λ_{max} means the wavelength at the highest transmission
- SP, λ_0 Centre wavelength: middle of the filter band, measured at 50 % of T_{max}
- T_{max} maximum transmission
- HW Width of the band pass, measured at 50 % of T_{max}
- zW Width at 10 % of T_{max}
- hW Width at 1 % of T_{max}
- tW Width at 0,1 % of T_{max}
- KS Steepness of the flanks
Proportion of zW/HW, hW/HW, tW/HW
The most commonly used, is the unit tW/HW



Blocking:

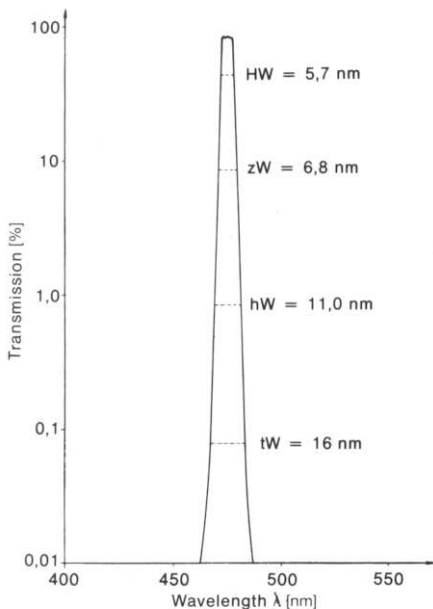
Blocking indicates in which wavelength region the secondary maxima are suppressed to a transmission $T \leq 1 \times 10^{-4}$. This means, for example, that for a blocking specification of x-ray - 1200 nm $T \leq 1 \times 10^{-4}$, the transmission at 1200 nm rises from a very high degree of suppression to 1×10^{-4} . The average transmission in the blocking region is 10^{-5} .

Dielectric interference filters consist of two or more dielectric layers, which are separated by certain numbers of distance coatings.

The attributes of a filter are dependent on the number of layers, the reflexion of each layer and the thickness of the distance coating.

The area of the self blocking of a filter is given by the width of the layers and amounts in the visible area about 100 nm at the short and longwave side.

Through cementing with blocking filters (13-layers, 16-layers) and, or with color glasses, the blocking can be expanded to each desired area. The blocking area should not reach much farther than the sensitivity of the transceiver, since additional blocking weakens the transmission of the filter band.



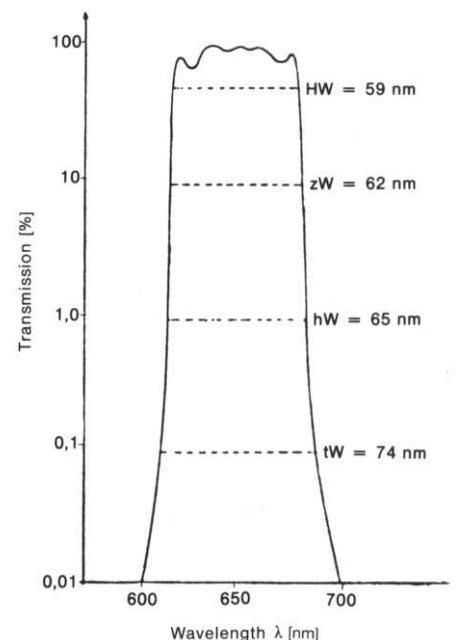
4-layer filter



This type is already very close to the ideal rectangular form. It possesses 3 zeros of reflexion beside each other, which cause the wide plateau shape wave form of the transmission maximum.

Flank steepness: $tW/HW \sim$ equal 3

Halfbandwidths of 3 nm to about 20 nm can be produced in the visible area.

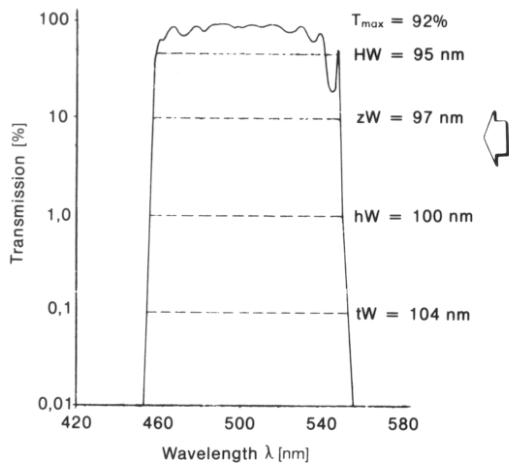


6-layer filter

The rectangular form is still better realized here. This type possesses 5 zeros of reflexion, whereby the number of the waves of the transmission maximum rises to 5.

Flank steepness: $tW/HW \sim$ equal 1,3

Halfband width variable from about 20 to about 60 nm.



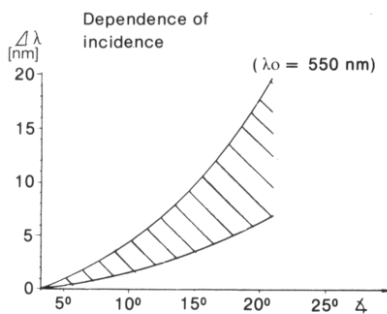
13-layer filter

This filter type is used as a bandpass filter and a blocking filter. Its flank steepness tW/HW is about 1.1. The transmission averages about 90 %.

16-layer filter

This is an expansion of the 13-layer filter. It is also used as a bandpass filter and a blocking filter. Halfbandwidths of more than 200 nm are possible.

Dependences of the wavelength: The halfbandwidth and the self blocking of interference filters are approximately proportional to the wavelength.



Dependence of incidence:

By indirect incidence the maximum of transmission moves to shorter wavelengths.

The shifting is a function of the angle of incidence and the refractive index of the distance coating and the wavelength. Filters for use up to 25° angle of incidence can be produced with a $HW \geq 10$ nm.

The relation reads

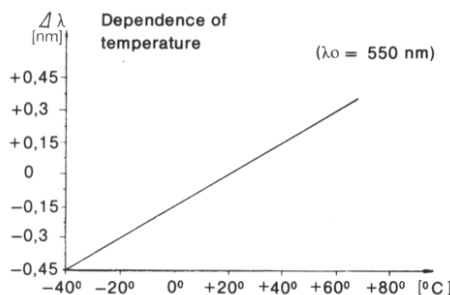
$$\frac{\lambda_{\alpha}}{\lambda_0} = \left(\frac{n^2 - \sin^2 \alpha}{n^2} \right)^{1/2}$$

α = angle of incidence

λ_{α} = wavelength by angle of incidence

λ_0 = wavelength of the filter at direct incidence

n = refractive index of the distance coating



Dependence of temperature:

The centre wavelength is dependent on the temperature. A rise of the temperature of about 20° C will cause a shifting to longer wavelengths of about 0,15-0,2 nm.

Durability:

Admissible temperature range: -30 to +50° C. At 50° C a relative humidity of 80% should not be exceeded.

The dependence of temperature and angle of the interference filter makes it clear why the rectangular form of the curve of the transmission is so favorable.

Deterioration: Through the use of special coating materials, we can prevent a changing of the transmission by deterioration and also a shifting of λ_{max} to other wavelengths. Our filters are sealed at the edges and bevelled on both sides.

Sizes: Up to $\varnothing 50,8$ mm or square. Further sizes on request.

We have available an abundant stock of interference filters. In most cases it is possible to deliver single filters out of stock within a few days.

Special production: Our flexible production methods are able to produce filters of each desired wavelength in the area of 302 nm up to 1600 nm according to your specifications, at low prices. Minimum order is 1 batch. If you let us know your desired specifications, we would be pleased to send you an offer. Upon your request we ask you to furnish us the following information: Wavelength, bandwidth, diameter, maximum thickness, desired transmission, suppressed degree of undesirable wavelengths, blocking to IR and angle of incidence.

Our longtime experience in the manufacture of interference filters has shown that a personal contact between customer and manufacturer is in most cases indispensable. Only in this way are we able to find the optimum solution for each application. Problems regarding the energy adaption of filters to the sensitivity of your receiver can be corrected by integral assimilation.

Literature: H. Anders, „Dünne Schichten für die Optik“, Wissenschaftl. Verlagsges., Stuttgart – 1965.
H. Anders, „Thin films in optics“, Focal Press London and New York – 1967.