

# Interference filters for the IR-spectrum region

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**Abstract** - The five-layer structure of dielectric interference filter for the infra-red region of spectrum was researched. The refractive indices optimal and thicknesses of individual layers are obtained for thin-film filter with interference mirror.

**Keywords** - Interference filter, narrow-band filter, band-pass filter, interference mirror.

## I. INTRODUCTION

The synthesis of the multi-layered optical systems gained large enough development in the last few years, successes of these researches influence both on development of optics and other branches of science and technique. Interference filters find application in a number of optical devices, and actually determine efficiency and reliability of apparatus on the whole. The basic requirements belong to such filters: maximum of passing of energy in the band of transmission, minimum passing of energy out of band of transmission. Presently get the interference filters of any type for all of optical range with the set spectral descriptions.

## II. NARROW BAND INTERFERENCE FILTERS

We are offered the structure of narrow-band interference filter, advantage of which consisted in that it consisted only of five layers [1], thus, substrate was basis of filter and simultaneously one of basic layers of all of the multi-layered system of HL 500H LH, where H and L layers of materials accordingly with high ( $n_H = 4.01$ ) and low ( $n_L = 1.44$ ) by indexes refractions; the optical thickness of which is equal to the quarter-wave, size 500 means that the optical thickness of separate layer is equal  $500\lambda_0/4$ . Such filter can be designed on any wave-length (see fig. 1).

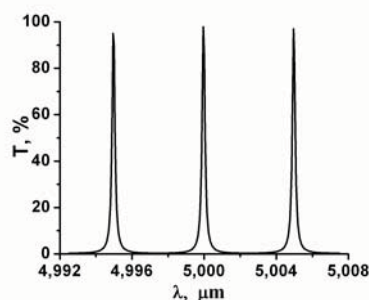


Fig.1 Spectrum of transmission of interference filter (used materials are Ge and SrF<sub>2</sub>)

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At the fixed values of transmittance of the system the width of band of transmission can be changed by modification of thickness of dividing layer. For designed filter with materials of Ge and SrF<sub>2</sub> the value of maximal coefficient of transmission equal 98%, minimal coefficient of transmission – 0.5%

## III. PASS BAND INTERFERENCE FILTERS

In work [2] the structure, which includes of interference mirror that is limited with two bands by dielectric layers of equal thickness and high refractive index without substrate, is proposed. To take into account substrate and get transmission maximum on work wavelength is entered an agreement layer which is placed between substrate and layer with the high index of refraction. Refractive index this layer is:

$$n_{ag} = n_s, \quad (1)$$

where  $n_{ag}$  is refractive index of agreement layer;  $n_s$  is refractive index of substrate. The calculations are conducted for material with refractive indices 4.01, 5.44 and 7.20, respectively. The thicknesses these layers are equal to  $0.3117 \mu m$ ,  $0.2289 \mu m$  and  $0.1517 \mu m$ , respectively. Refractive index of substrate is 2.00. Transmission spectrums of such structures are presented on fig. 2

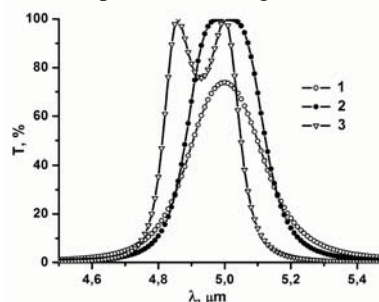


Fig. 2 Dependences of transmittance from wavelength of thin-film filter of type: dielectric – interference mirror – dielectric: curve 1 –  $n=4.01$ ,  $d=0.3117 \mu m$ ; curve 2 –  $n=5.44$ ,  $d=0.2289 \mu m$ ; curve 3 –  $n=7$ ,  $d=0.1517 \mu m$ .

## IV. CONCLUSION

The structures of considered interference filters are technological enough as a result of using a few of layers and simple constructions.

## REFERENCES

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