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THE RESEARCH OF OPTICAL PROPERTIES OF ZRO_2/SIO_2 AND HFO_2/SIO_2 MULTILAYERED STRUCTURES

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We researched optical characteristics of ZrO_2/SiO_2 and HfO_2/SiO_2 multilayered optical coatings for definition of possible area of their application. During the work we have investigated these multilayered structures. Two set-ups have been created for experimental revealing of their area of application. The first set-up was made for measurement of the reflection factor as a function of the illuminating light wavelength. The second set-up was used for measurement of the reflection factor of monochromatic light in dependence of the reflection angle.

It is necessary to notice that there is a big problem of the reflection reduction in the optical industry. Because of their industrial importance, antireflection coatings for the visible and infrared spectral region are the subject of investigation and production. So as it is impossible to create an antireflection coating across the wide spectrum range every type of coating has only its spectral range in which they revealing their optimal antireflection properties. It's known that multilayer optical structures have unique optical properties enable one to create coating with reflection factor less then 1%. So as the techniques of production of the layers which thickness doesn't exceed several nanometers are well elaborated the new methods of creation of multilayer antireflection coatings are developed. It is well-known that the multilayered structure is created by changing in the sequence of used materials. For example: a hafnium oxide layer, a silicon oxide layer, again a hafnium oxide layer and so on. To ensure that the experimental set-up and the measurement method allows as obtain correct data, first of all the optical properties of a usual quartz plate were investigated and compared with data received by theoretical calculation.

The HfO_2/SiO_2 multilayer coatings were illuminated by 532 nm laser beam and it was found out that the reflection factor of this type of coating reaches 35 %. In the visible range the reflection factor is 40±5%. Since the required factor depending on the wavelength changes poorly, it was revealed that HfO_2/SiO_2 multilayer coatings have doubtful antireflection properties. The ZrO_2/SiO_2 multilayer optical structure in turn shows frequency selectivity. And its reflection factor changes from 1 % to 45 %. It was found out that at relatively big angle of reflection of the He-Ne laser beam this structure gets properties of a mirror. Summing up, it is necessary to notice that the ZrO_2/SiO_2 antireflection coatings have very law reflectance of normally falling light in the far red and infra-red region. This allows using these coatings in devices of night vision.