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Gradient optical filters for medical applications

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Low energy light has been continuously gaining importance in medical practice. Its pain-relieving as well as regenerating and microcirculation enhancing activity are well recognized. It has also been shown that polarized light exhibits bio-stimulating properties. Light utilizing techniques require optical filters with their aim being a removal of unwanted wavelengths from the spectrum emitted by the source. Interference filters are constructed as stack multilayer systems composed of alternated films of high and low refractive index materials. Frequently, low adhesion between these materials causes destruction of the filters and physical effects on interphase boundaries makes them difficult to manufacture. This work introduces a novel attitude towards optical filters. A manufacture of filters with a gradient change of refractive index is presented. This gradient results from periodic change of the coating composition, predetermined in the phase of filter design. In the filter realization phase, two materials are deposited. One is silicon dioxide with refractive index of 1.45, while the other comprises silicon nitride with refractive index equal 2.20, changing their proportions in a continuous and periodic manner results in a gradient periodic change of material refractive index. The technology comprises radio frequency plasma enhanced chemical vapor deposition with a use of tetramethyldisilazane as precursor. A use of nitrogen as a reaction medium leads to silicon nitride coatings, while an application of oxygen results in silicon dioxide films. When the process is carried out in a mixture of nitrogen and oxygen, a material with predetermined value of its index of refraction is deposited.

Biography

Hieronim Szymanowski is a Professor at the Lodz University of Technology, Institute of Materials Science and Engineering, Poland. His main areas of expertise are thin film technology both PE CVD and PVD, optical applications, surface engineering, composite materials. He has authored more than 80 scientific publications.

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