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Visible color filtering through periodic nanoscale hole arrays and its polarization properties

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The interaction between metal films with nanoscale hole-arrays and incident light makes extraordinary transmission effect owing to surface plasmons (SPs). This interesting phenomenon is due to the trapped light waves and free electrons of the metallic conductor which lead to the resonance of the electromagnetic field of the light and the surface charge oscillation. When the light penetrates hole-arrays on surface of metal films, the plasmonic transmission also occurs although the size of holes is smaller than the wavelength of incident light. Special color selectivity of the nano-level hole-array structure can be applied to an ultrahigh resolution charged coupled device (CCD) or a bio-compatible artificial retina due to its unique structural effect and material property. For a CCD, the pixel size is smaller than $1\mu m^2$. Therefore, general color filter system meets severe process limit with complicated fabrication steps. Structural color filter can be essential component to give an artificial retina the color signal. To achieve the goal, bio-safety of materials and structures is essential. We believe that the visible color filter with plasmonic effect just using metal or inorganic material can be a strong candidate for the application.

Visible spectra have been measured under the variable size of holes, pitch between adjacent holes, and different structures. Various transmittance peaks on each wavelength have been shown with the designed parameters. The smaller size of the holes induces to high color purity, even though the total transmittance is decreased. To present more than two colors, polarization effect also will be introduced.

Biography

Seunguk Kim received the B.Eng. degree from Hanyang University, Korea, in 2012. Currently, he is pursuing his integrated M.Eng. & Ph.D. course in Daegu Gyeongbuk Institute of Science & Technology (DGIST), Korea. He is interested in nanoplasmonics, optical interference, and nano-level lithography methods.

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