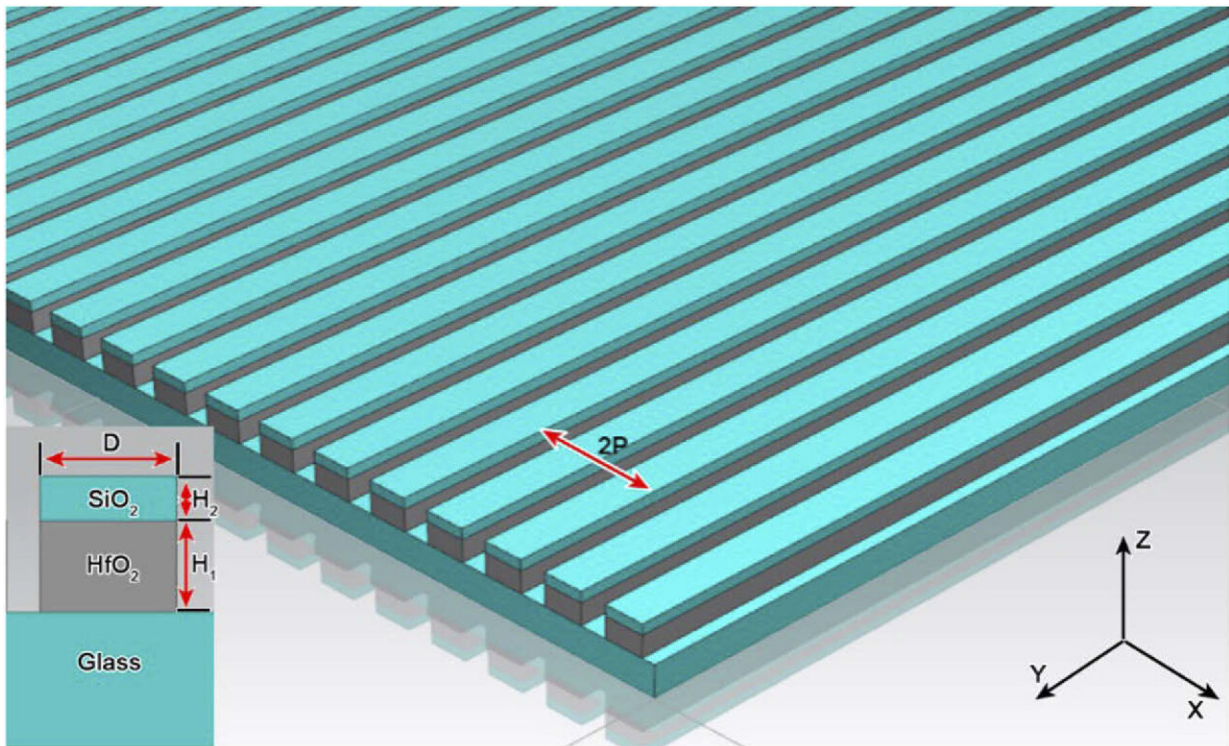


All-dielectric grating structure color filter for sensing and display imaging

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Schematic diagram of all-dielectric grating structure. Credit: *Optics Express* (2022). DOI: 10.1364/OE.453155

Compared with traditional color dyes, structural color has the advantages of high resolution and good stability, which can achieve full-tone modulation in the visible light range. All-dielectric metasurface structures are proposed to replace plasmonic metasurfaces with higher

losses. Due to the existence of high-order dipole resonance mode in the short-wave range, the enhancement of color saturation is limited. The researchers propose a feasible scheme to suppress the high-order dipole mode to solve this problem.

In a study published in *Optics Express*, a research group led by Prof. Gao Jinsong from the Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP) of the Chinese Academy of Sciences (CAS) proposed an all-dielectric grating structure color filter with narrow bandwidth and high-quality factor.

Using the finite difference time domain method, researchers conducted an in-depth comparative study on HfO_2 gratings and $\text{SiO}_2/\text{HfO}_2$ gratings. In this process, Gao and his group found that the addition of the SiO_2 layer effectively suppressed the generation trend of high-order dipole mode and improved the saturation of the [structural color](#). The physical mechanism of the result was explained by the magnetic field distribution and the electric field vector diagram. They then explored the influence of the structural parameters on the spectral curve and the sensitivity of the polarization state.

Based on the findings, the all-dielectric grating proposed by the researchers ensured that the reflectivity at the peak position is close to 1, and the transmittance at the non-resonant peak position exceeds 99%. The realization chromaticity coordinates occupied most of the area of the CIE-1931 chromaticity diagram. By adjusting the duty cycle, researchers obtained the excellent spectral characteristics with the FWHM = 2 nm and the quality factor $Q = 424.5$.

This all-dielectric grating has excellent characteristics of high [structural color](#) quality, low full width of half maximum and high-quality factor, which is of great significance to the fields of sensing, display imaging and other fields, according to the researchers.

More information: Yuanhang Zhao et al, Multi-layered all-dielectric grating visible color filter with a narrow band and high-quality factor, *Optics Express* (2022). [DOI: 10.1364/OE.453155](https://doi.org/10.1364/OE.453155)

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