Plasmonic multispectral color filters based on nanoimprint lithography

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Abstract: Image sensors equipped with color filter arrays are widely used for capturing high resolution color images and advanced spectroscopy. In recent years, hyperspectral and multispectral color filters have been extensively studied in advanced imaging applications exploiting their superior spectral resolution both in terms of narrow linewidths and high transmission intensities. These color filters that are the most effective in terms of linewidths and efficiency are often the most expensive to fabricate. This is due to the fact that they require a three-dimensional topography with many different thicknesses to target different spectral transmission bands. Plasmonic color filters can be designed in such a way that the transmission bands can be adjusted solely by modifying the lateral dimensions of the unit cell. This ability to tailor the transmission bands makes plasmonic color filters a cost-effective alternative. We have recently designed hybrid dielectric-plasmonic color filters and fabricated them on glass wafers in our 200mm pilot line using conventional CMOS processing [1]. These filters exhibit outstanding optical performance over the visible spectrum, with linewidths down to 30 nm and the transmission efficiencies exceeding 50%. In this work, we present a much-simplified process flow for the same filters based on nano-imprint lithography (NIL), severely reducing the amount of required process steps and the associated fabrication cost. Also, we are investigating the effect of residual layer thickness (RLT) and passivation thickness variation on transmission efficiencies using FDTD simulations.

Reference:

[1] A. De Proft et al., "Highly selective color filters based on hybrid plasmonic-dielectric nanostructures", *ACS Photonics* **9**(4) pp. 1349-1357 (2022).