Supporting information for

Enlarged Color Gamut Representation Enabled by Transferable Silicon Nanowire Arrays on Metal-Insulator-Metal Films

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S1. Reflectance properties and color representations of the MIM(Ag/SiO_2/Ag)

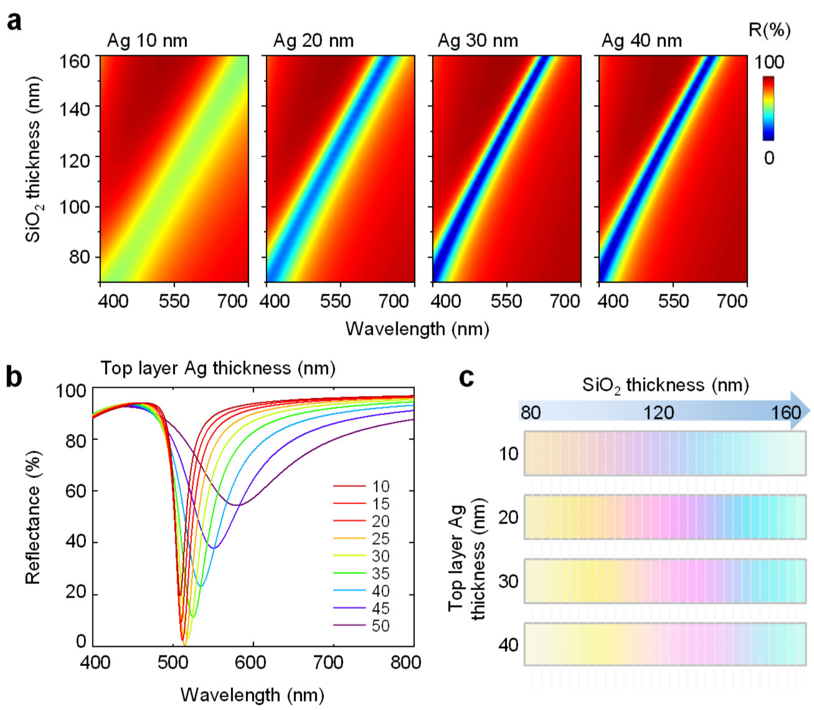

Figure S1 (a) Contour plots for reflectance spectra of MIM structures varying SiO_2 thickness in four cases of top silver layer (e.g. 10, 20, 30, 40 nm) (b) MIM structures reflectance varying top silver layers from 10 to 50 nm in 5 nm steps with 120 nm thickness of SiO_2 (c) Colour representations corresponding to reflectance spectra shown in (a).

S2. Reflectance and absorption properties of the MIMIM multi-layer

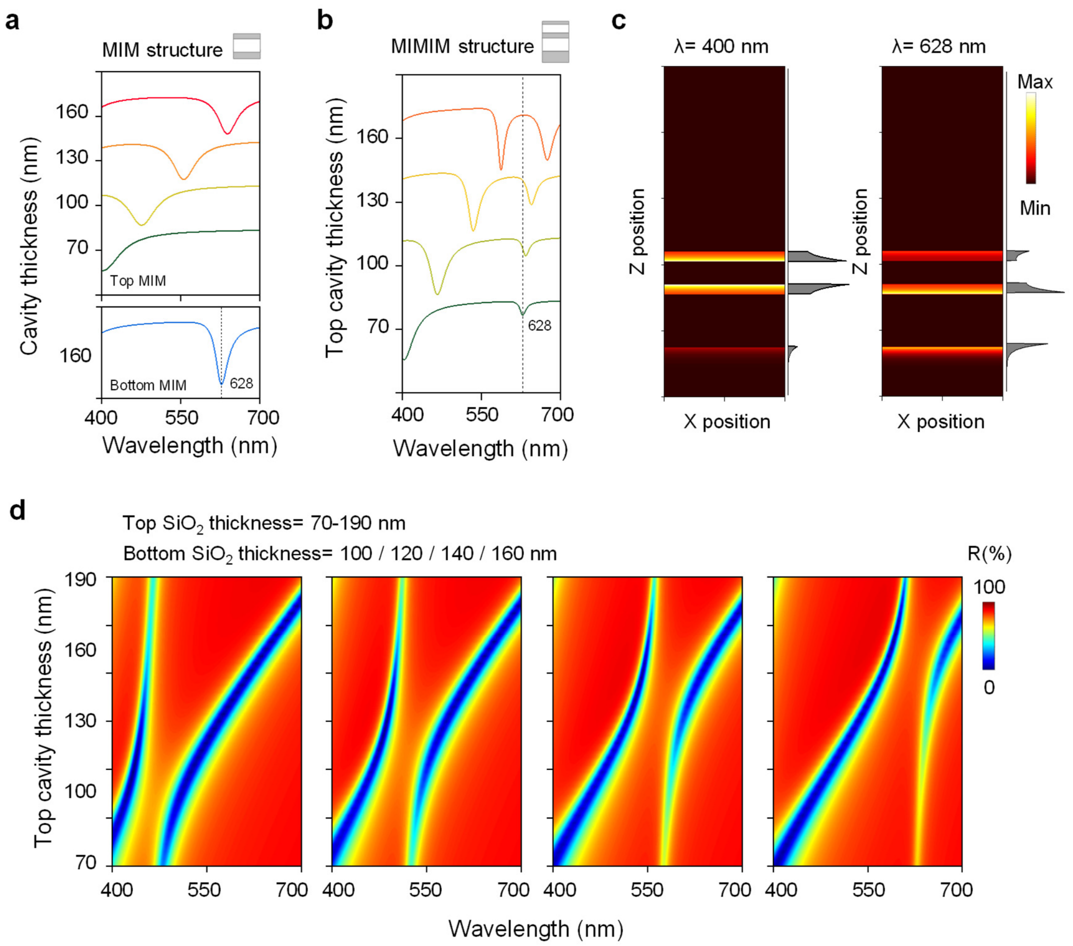

Figure S2 Calculated reflectance spectra. (a) Top MIM: Ag(30nm)/SiO_2(70, 100, 130, 160nm)/Ag(30nm) and bottom MIM: Ag(30nm)/SiO_2(160nm)/Ag(100nm) (b) MIMIM: Ag(30nm)/SiO_2(70, 100, 130, 160nm)/Ag(30nm)/SiO_2(160nm)/Ag(100nm) (c) Absorption profiles for MIMIM (d) Contour reflectance plots for MIMIM varying top/bottom cavities.

S3. Reflectance properties and color representations of the Si-NWAs height, period, refractive index and gap dependence

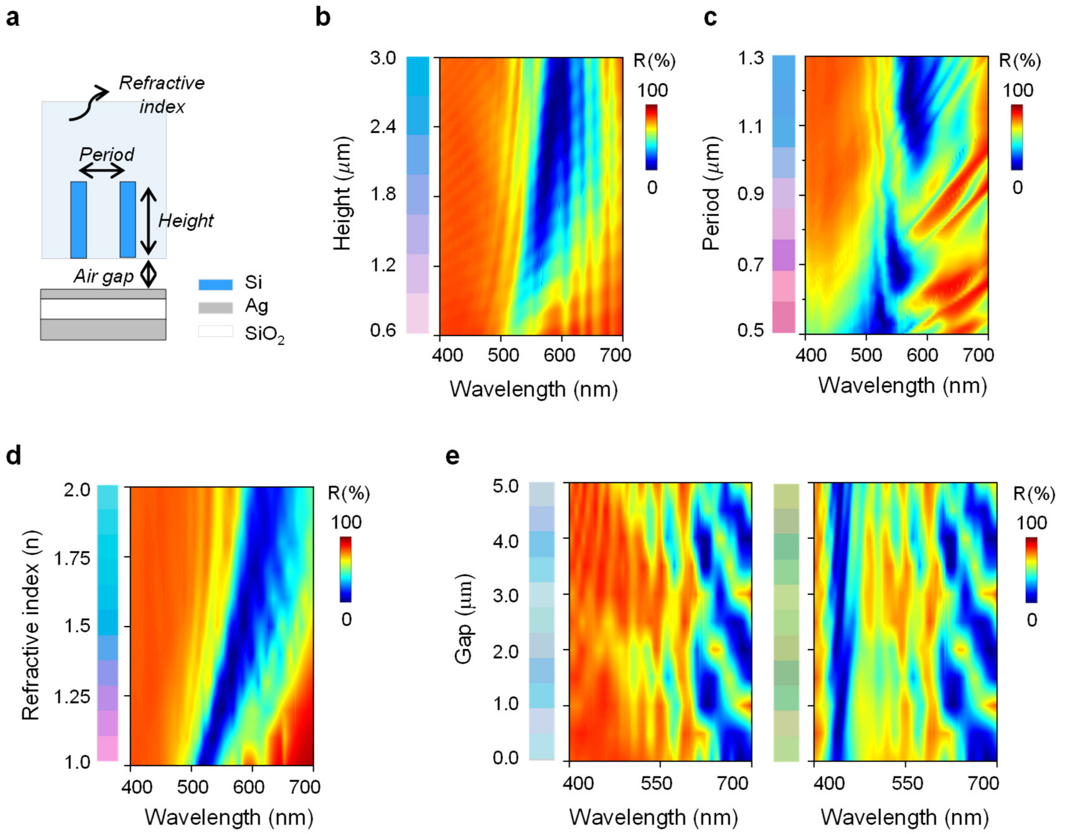

Figure S3. (a) Schematic illustration for simulation conditions, (b, c, d, e) Contour plots for calculated reflectance spectra and color representations: (b) Nanowire height, (c) Period, (d) Background refractive index and (e) Air gap

S4. Angle dependence properties of TSNA-MIM

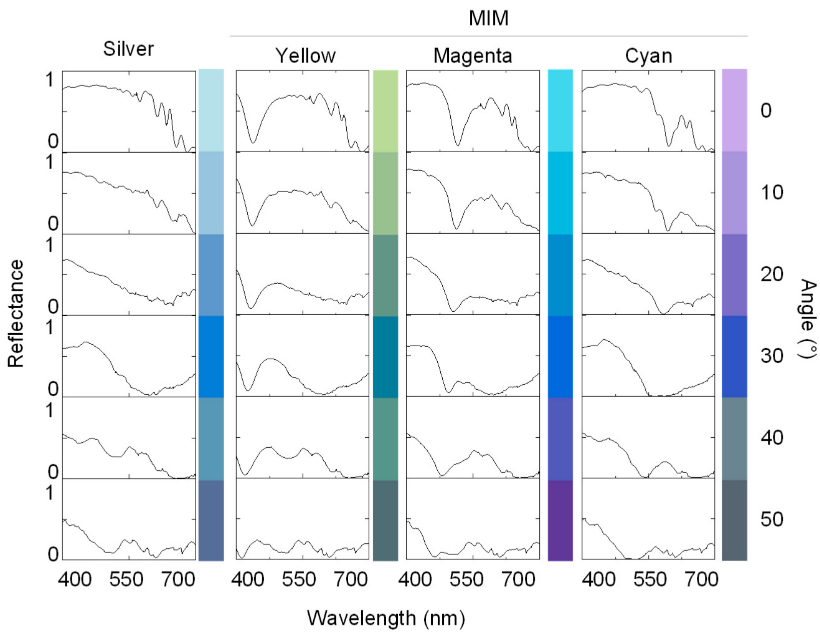

Figure S4. Simulation results of reflectance spectra and color representations for angle dependence of silicon nanowire arrays on silver and MIM surface. (Silicon nanowire arrays: height= 2 μm, diameter= 100 nm, period= 1250 nm / MIM: Ag 30 nm/ SiO_2 90, 120, 150 nm/ Ag 100 nm)

S5. CIE 1931 color space for color representation

The CIE 1931 color space was used to obtain the color representation of the fabricated samples from the simulated and measured reflectance spectrum in the visible wavelengths. The color information was expressed by the tristimulus values, which comprises X, Y, and Z, conceptualized as amounts of three primary red, green, blue colors in a tri-chromatic additive color model. In order to convert from reflectance spectral data to chromatic value, the tristimulus value is used by following equations:

$$X = \int I(\lambda)\bar{x}(\lambda)\, d\lambda$$
$$Y = \int I(\lambda)\bar{y}(\lambda)\, d\lambda$$
$$Z = \int I(\lambda)\bar{z}(\lambda)\, d\lambda$$

$\bar{x}(\lambda)$, $\bar{y}(\lambda)$, and $\bar{z}(\lambda)$ are the CIE's color matching functions, which are the numerical description of the chromatic response of the observer. In our calculation, the CIE 1931 standard observer function,[1] the most generally used, was employed as the color matching function (Figure S1). In the equation, reflectance, which is calculated or measured in our study, is multiplied by the color matching function as a spectral power distribution ($(I(\lambda))$). In the CIE color coordinate, the chromaticity of a color was specified by the two derived parameters x and y, and two of the three normalized values are functions of three tristimulus values X, Y, and Z by following equations:

$$x = \frac{X}{X+Y+Z}$$
$$y = \frac{Y}{X+Y+Z}$$

From the calculated tristimulus values, RGB values is converted by the matrix as follows:

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 0.41847 & -0.15866 & -0.082835 \\ -0.091169 & 0.25243 & 0.015708 \\ 0.00092090 & -0.0025498 & 0.17860 \end{bmatrix} \cdot \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

In this study, we calculated these above equations by using MATLAB.

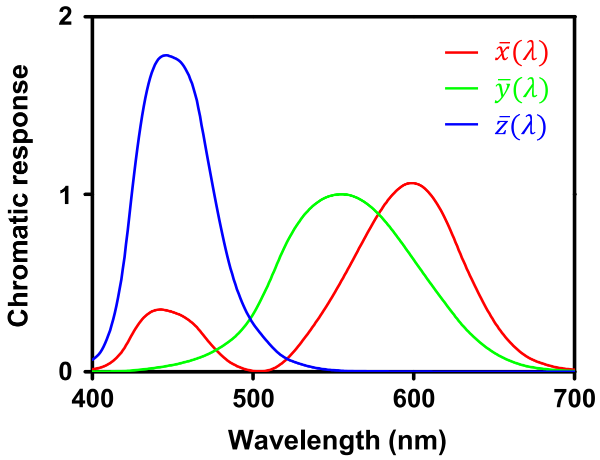

Figure S5. Chromatic response of the color matching functions from *CIE 1931 standard observer*[1]

Reference

[S1] H. S. Fairman; M. H. Brill; H. Hemmendinger, *Color Research & Application* **1997**, 22**,** 11–23

S6. Reflectance properties and color representations of the PDMS embedded vertical nanowire arrays for other materials

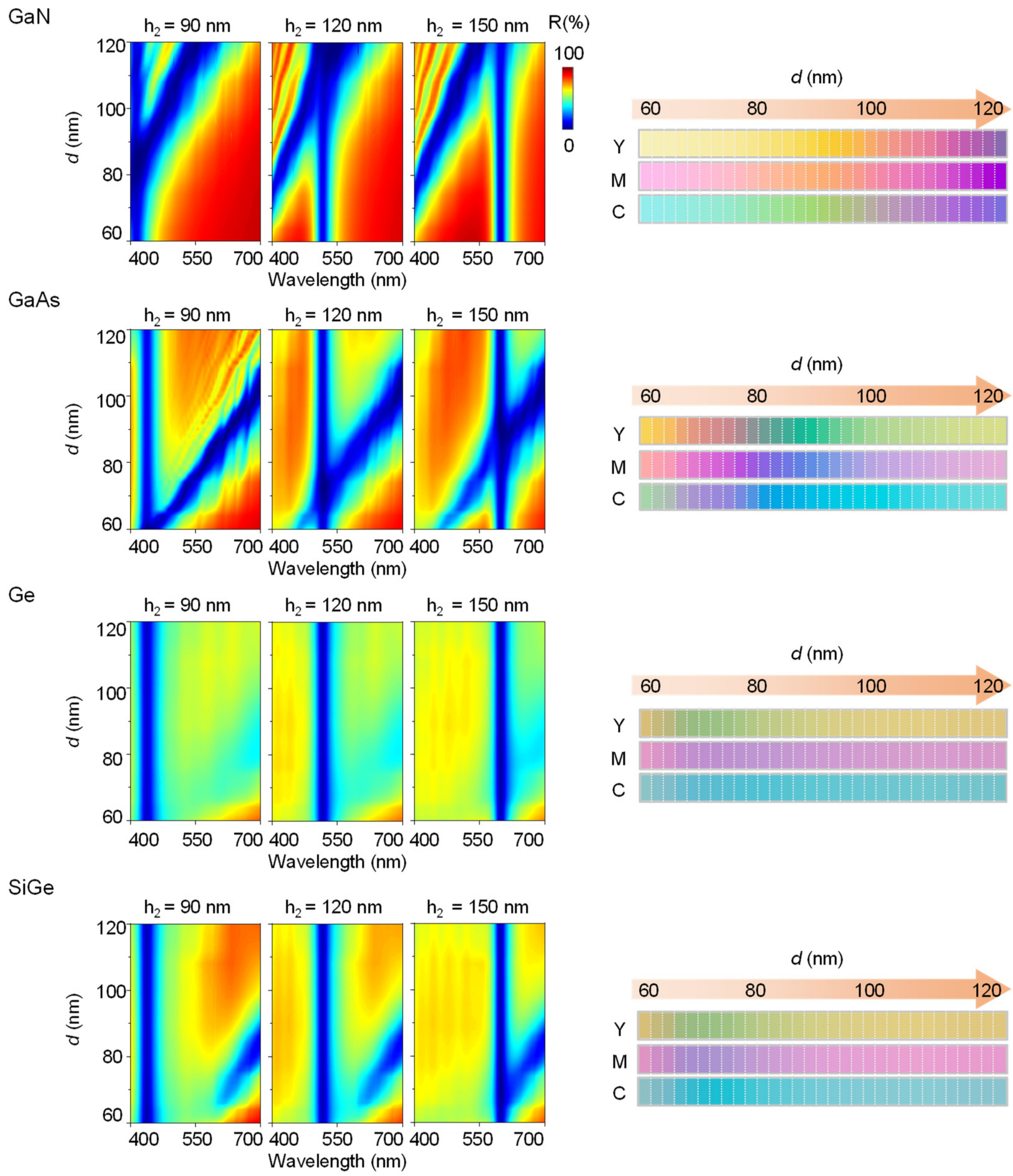

Figure S6 Contour plots for calculated reflectance spectra and color representations for diverse materials (e.g. GaN, GaAs, SiGe, Ge) in the wavelength range from 400 to 700 nm.

S7. Optical constants

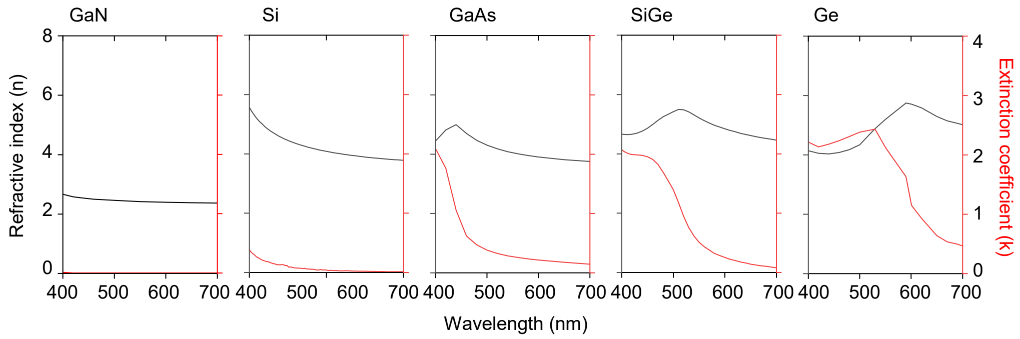

Figure S7 Refractive indices and extinction coefficients of diverse semiconductors (e.g. GaN, Si, GaAs, SiGe, Ge).