Method

EE, 20182327

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1. Materials and Methods

The OC and ML (OC&ML) are composed of SiO2. The OC and ML focus light on the CIS. The CF is composed of materials that have high transmittance to red, green, blue and white light; each CF is matched to a CIS. The CFs filters out light that is not in the desired wavelength range. The DTI is composed of SiO2. The DTI blocks light from neighboring CISs, and prevents leakage of internal light.

The CIS was simulated by FDTD simulation (Lumerical Inc). The program allows specification of material properties. We obtained the raw data by the four monitors (top, left, right and bottom) which can get transmittance. We used a 4ⅹ16 CPU cluster to run the program and can simulate the CIS in 2-dimensional space because of symmetry.

We conducted two simulations. First, we simulated the basic structure of a CIS on which light is shone in the normal direction. Second, we simulated the CIS in which the OC&ML and the CF were shifted. We shifted the OC&ML by d1 [nm] in 10-nm increments from 450 nm to 550 nm, and shifted the CF by d2 [nm] in 10-nm increments from 200 nm to 300 nm. Lastly, we simulated the CIS that had a tilted DTI. We tilted the DTI by in 0.5 increments from to . Our purpose to make the CIS with tilting DTI have almost the same QE as the CIS that has the basic structure. We plotted the power flows to determine the effect of tilting the DTI, and to show how the light moves into the detector.

QE is a variable that shows how much light of the desired wavelength is detected. Crosstalk is a variable that quantifies the amount of light that has undesired wavelength is leakage from neighbors. Our goal is to find the optimal setting for d1, d2, and to maximize QE and minimize crosstalk. If the top monitor is T1 is the left monitor is T2, the right monitor is T3, and the bottom monitor is T4, then

QE = -T1-(-T2+T3-T4) (1)

for all frequency spectra. To calculate the QE of each pixel, in each frequency band, we took an average value of them: QEred is the average QE from 590 nm to 650 nm, and QEgreen is the average from 500 nm to 560 nm, and QEblue is the average from 420 nm to 480 nm. Crosstalk can calculated as

, (2)

, (3)

. (4)

**Scientific Writing; Materials and Methods Section grading sheet.**

**Do I understand?** 7/10 …

**Structure:**

Paragraphs:

Present? 2/2

Topic sentences: 2/3 .

Coherent: 2/3 .

Sentences grammatical? 2/5 … many are not sentences.

Minimized word count? 2/3 .

**Grammar:**

The/a 3/3

Plurals: 3/3 .

Verb form: 2/3 .

Pronouns clearly matched to antecedents? 3/3

Prepositions: 2/2

**General (Formatting, Vocab)** 4/5 . justify; remove outline points

28/45 → \_\_\_\_9.33\_\_\_ /15

We will work on your English.