

## **Three-layer Organic-film Color Image Sensor**

### **—For compact, high-resolution single-chip cameras—**

- ❑ NHK is conducting R&D on imaging devices utilizing organic films that convert light to electrical signals, toward implementation of compact, high-resolution, single-chip cameras. We have developed a color image sensor with layered organic films.
- ❑ Typical image sensors for single-chip color cameras use a pixel mosaic pattern with color filters for red, green and blue. This method generates an image by collecting color information from multiple pixels, so the resolution of the image and utilization of light is lower than that of the actual pixel devices.
- ❑ In this research, we have developed a three-layer color image sensor using organic films that detect only blue and only green light, layered vertically over a CMOS<sup>1)</sup> image sensor that detects red light.
- ❑ Incident light passes the first organic layer, which absorbs only the blue light component and converts to an electrical signal, and is transparent to the green and red components. The second organic layer absorbs only the green component, and the red component is detected by the CMOS image sensor. The organic layers are combined with transparent thin-film transistors, and the signals output from each of the layers can be combined to reproduce a color image.
- ❑ This structure enables all color information of red, green and blue to be obtained within a single pixel, achieving a high-resolution image sensor that uses light more efficiently. We will continue to work reducing the pixel size and increasing the number of pixels, and accelerate R&D toward realizing a compact, high-resolution, single-chip camera.

\* The blue organic film was developed in collaboration with Nippon Kayaku Co., Ltd.

1) Complementary Metal-Oxide-Semiconductor

(Addendum)

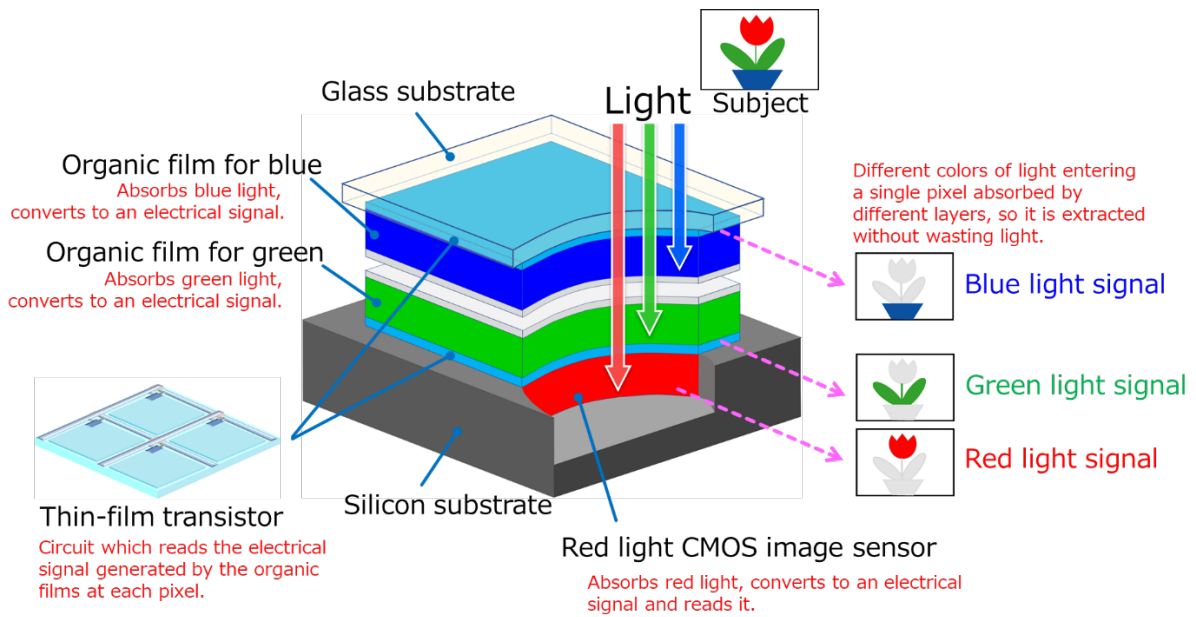


Figure 1: Three-layer color image sensor and operating principles

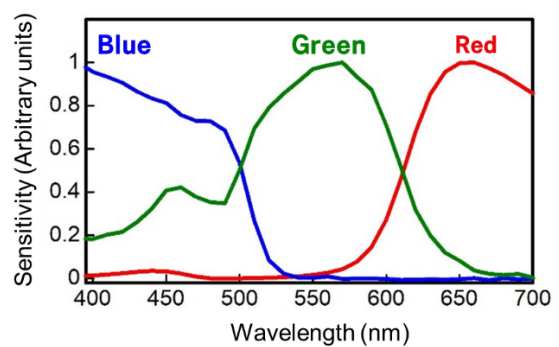
Table 1: Three-layer color image sensor specifications

|                  |   |
|------------------|---|
| Device structure | Organic film for blue (Layered over glass substrate) + organic film for green (layered over red CMOS image sensor)* |
| Pixels           | 320 (H) × 240 (V)   |
| Pixel pitch      | 20 μm   |
| Frame rate       | 60 frames/s   |

\*The blue organic film is placed facing green organic film.



(a)



(b)

Figure 2: Image reproduced by three-layer color image sensor (a) and spectral characteristics (b)