Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Programmable Self-Assembly of M13 Bacteriophage for Micro-Color Pattern with a Tunable Colorization

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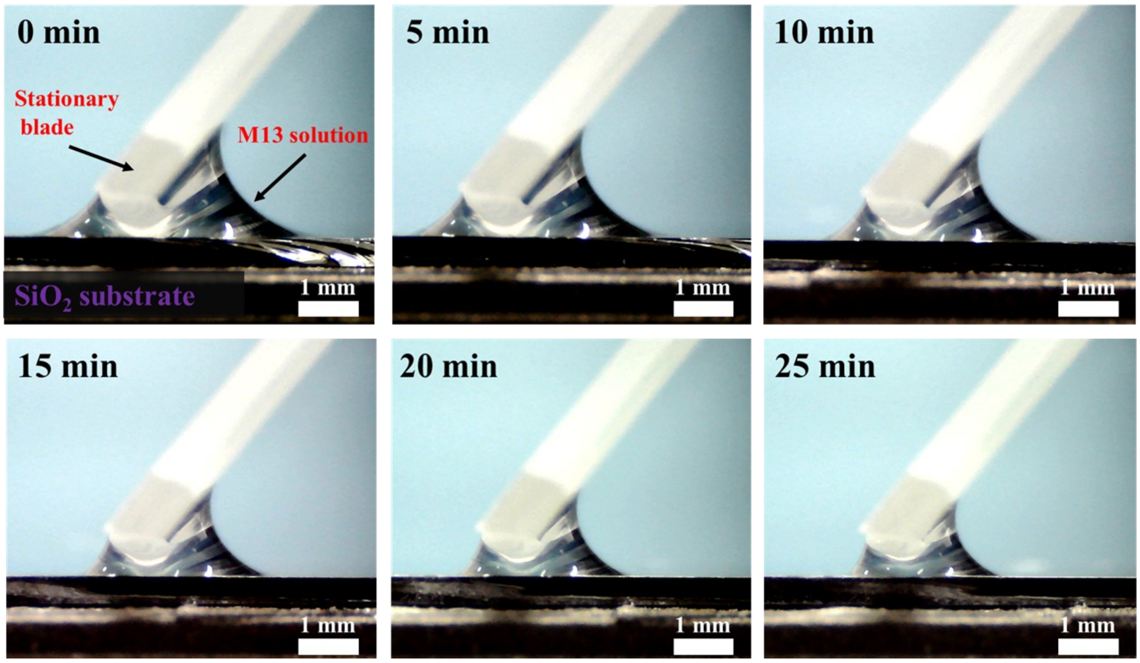

Figure S1. Photographs of M13 color film fabricating during MDD processing.

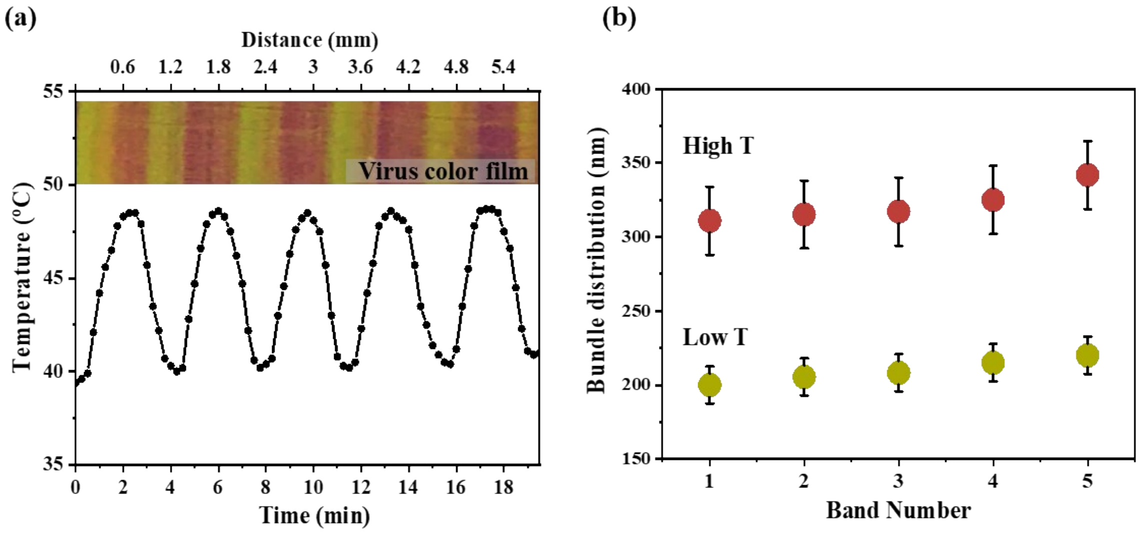

Figure S2. Effect of temperature condition at the interface meniscus in MDD system. (a) Diagram of temperature vibration corresponding with color response in the actual color film. The top x-axis is the coated-virus length corresponding with dragging-time at constant dragging speed (0.005 mm/s). (b) The bundle diameter of the M13 phage also vibrated cause the different color generation following the temperature conditions.

In figure S2(a), the virus color film is controlled by the temperature condition during the MDD processing. At the high-temperature condition, the bundle diameter becomes thicker, and the bundle-to-bundle distance increases. As a result, the constructive interference of the light scattered from the M13 phage color film with a thick bundle occurs at a long wavelength. In contrast, the bundle diameter was decreased at a lower temperature, so the constructive interference of light scattering occurs at a short wavelength. Consequently, a repeatable color gap was fabricated by altering the temperature conditions.

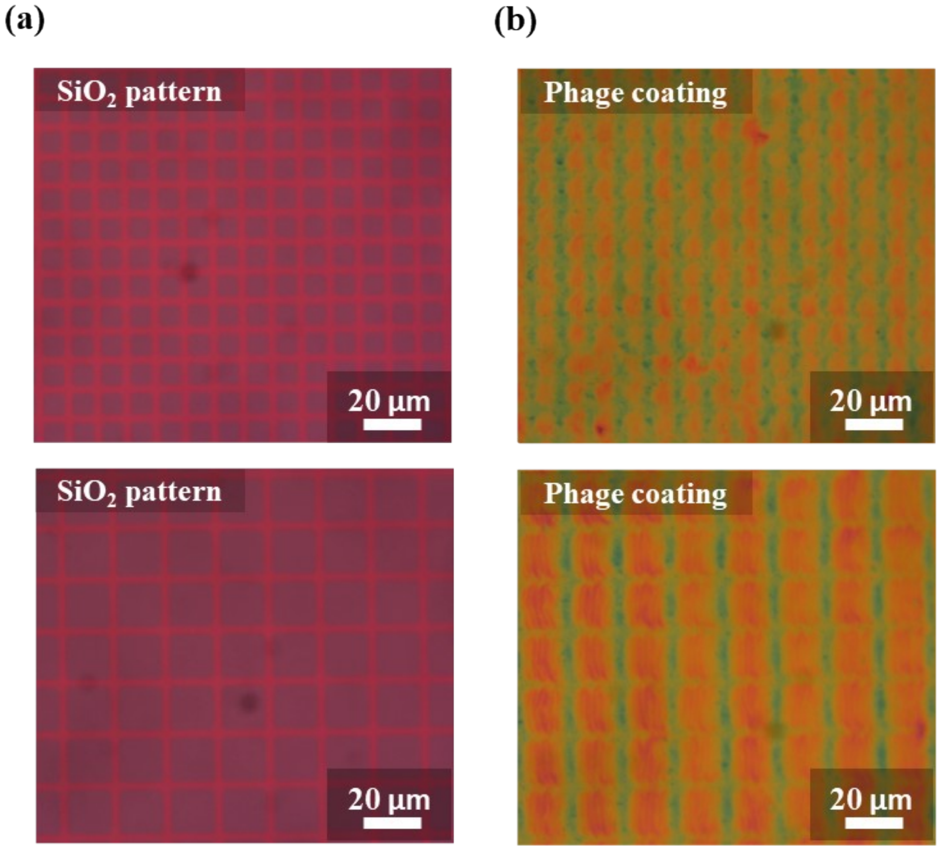

Figure S3. (a) Optical microscopy images of checkered stripe structure with the cube diameter are 10 μm, and 20 μm. (b) Photographs of checkered stripe structure after M13 phage coating. We can observe a distinct color from the cube areas and the stripes.

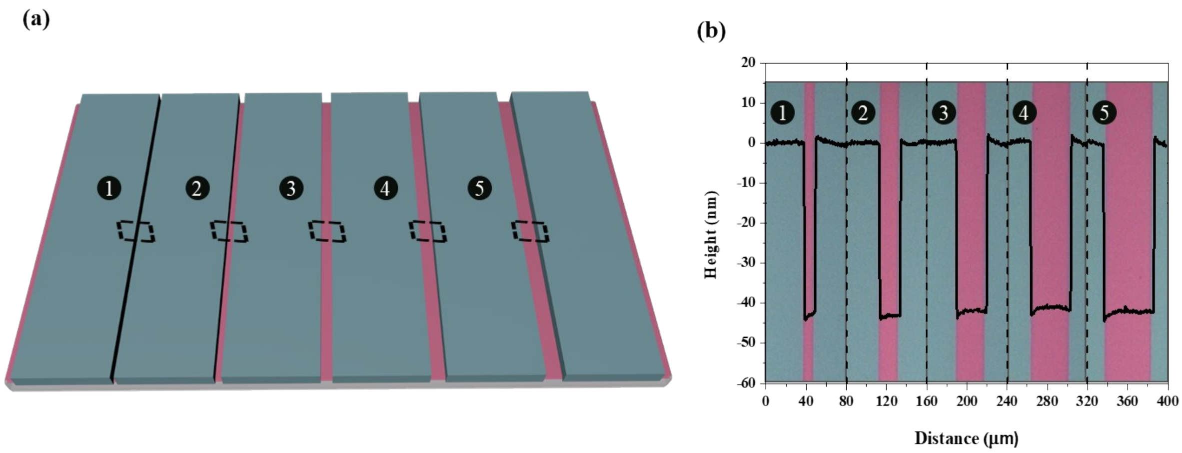

Figure S4: Micropattern by mimicking a barcode-like structure in Figure 2. (a) Micropattern illustration, the grooves have controlled the width from 10 to 50 μm and 40 nm in depth. The distance between two grooves is 250 μm. (b) AFM analysis of micropattern to confirm the width and depth of each groove.

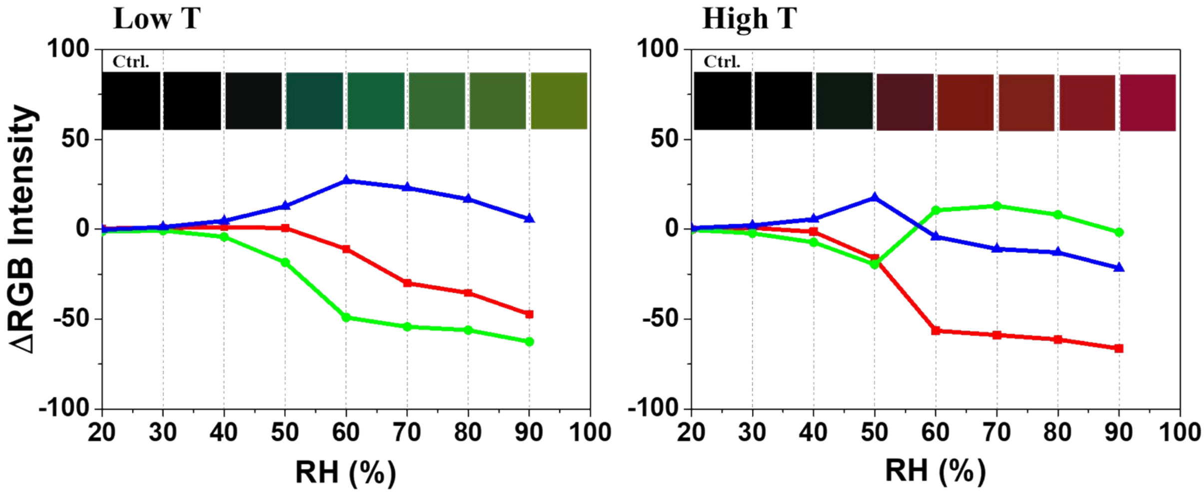

Figure S5: Real-time ΔRGB intensity of phage color can be generated for each humidity level.

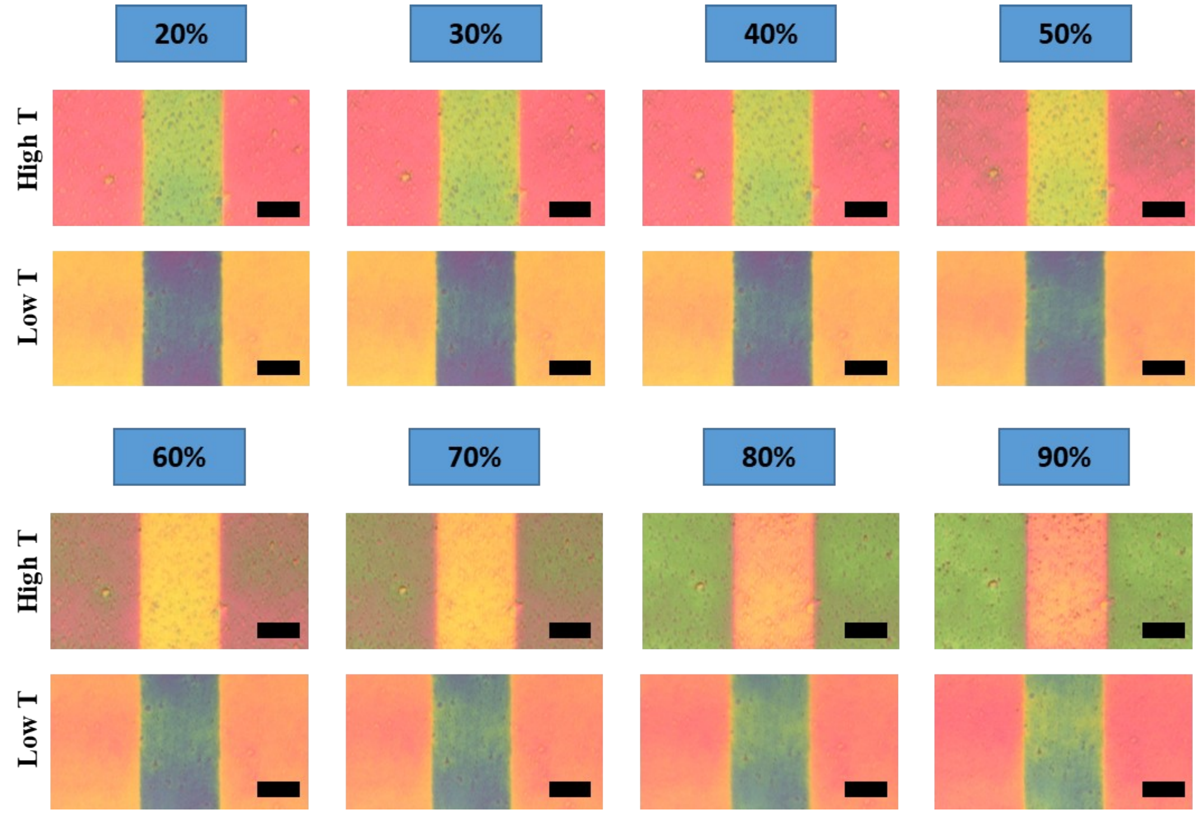

Figure S6: Photographs of color barcode-like film change responded under relative humidity (RH%) from 20 – 90%.

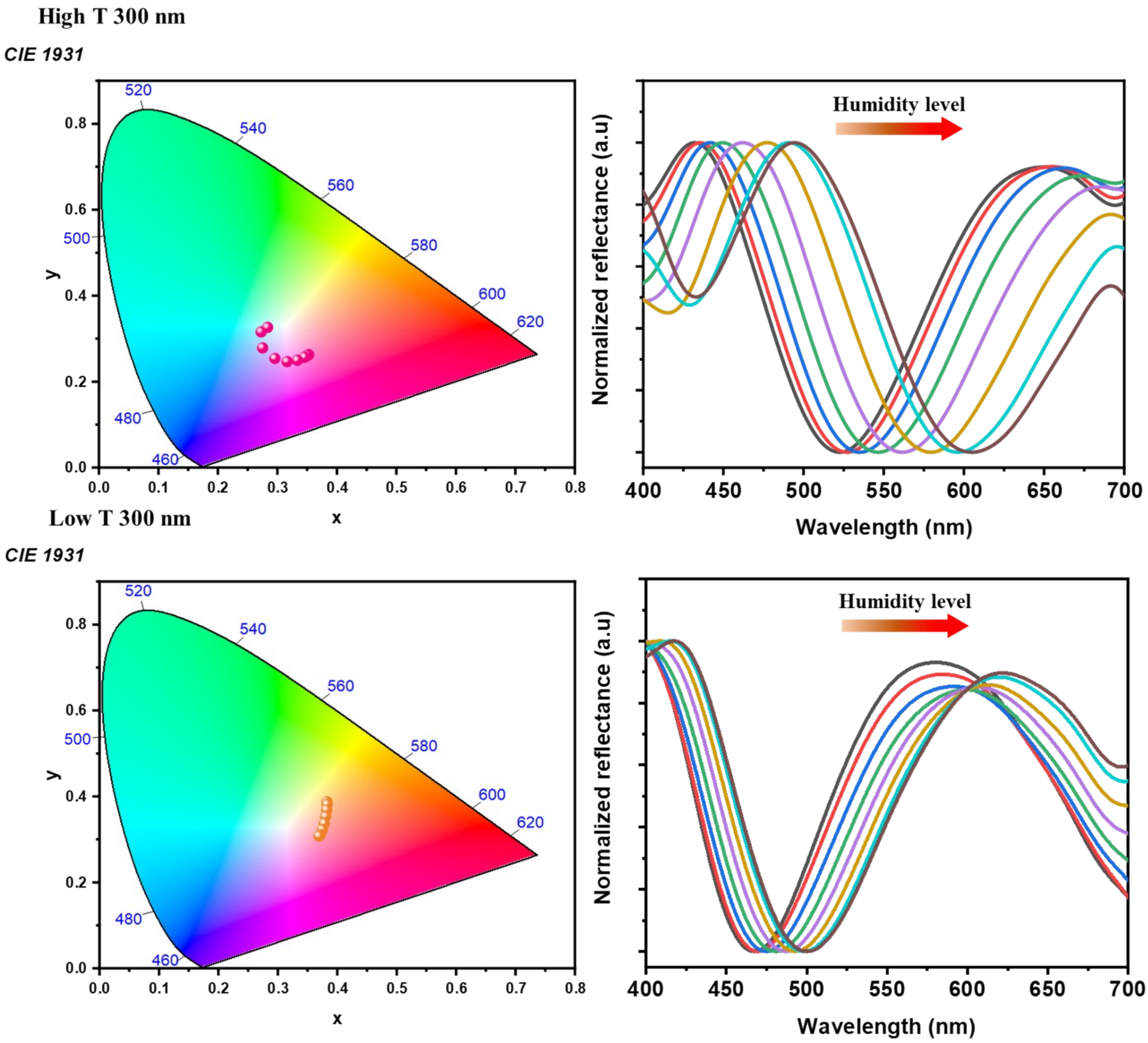

Figure S7. Chromaticity plots for RGB gamut on CIE coordinates show the distinct color generation from the barcode-like sensor at each area: High T 300 nm, Low T 300 nm

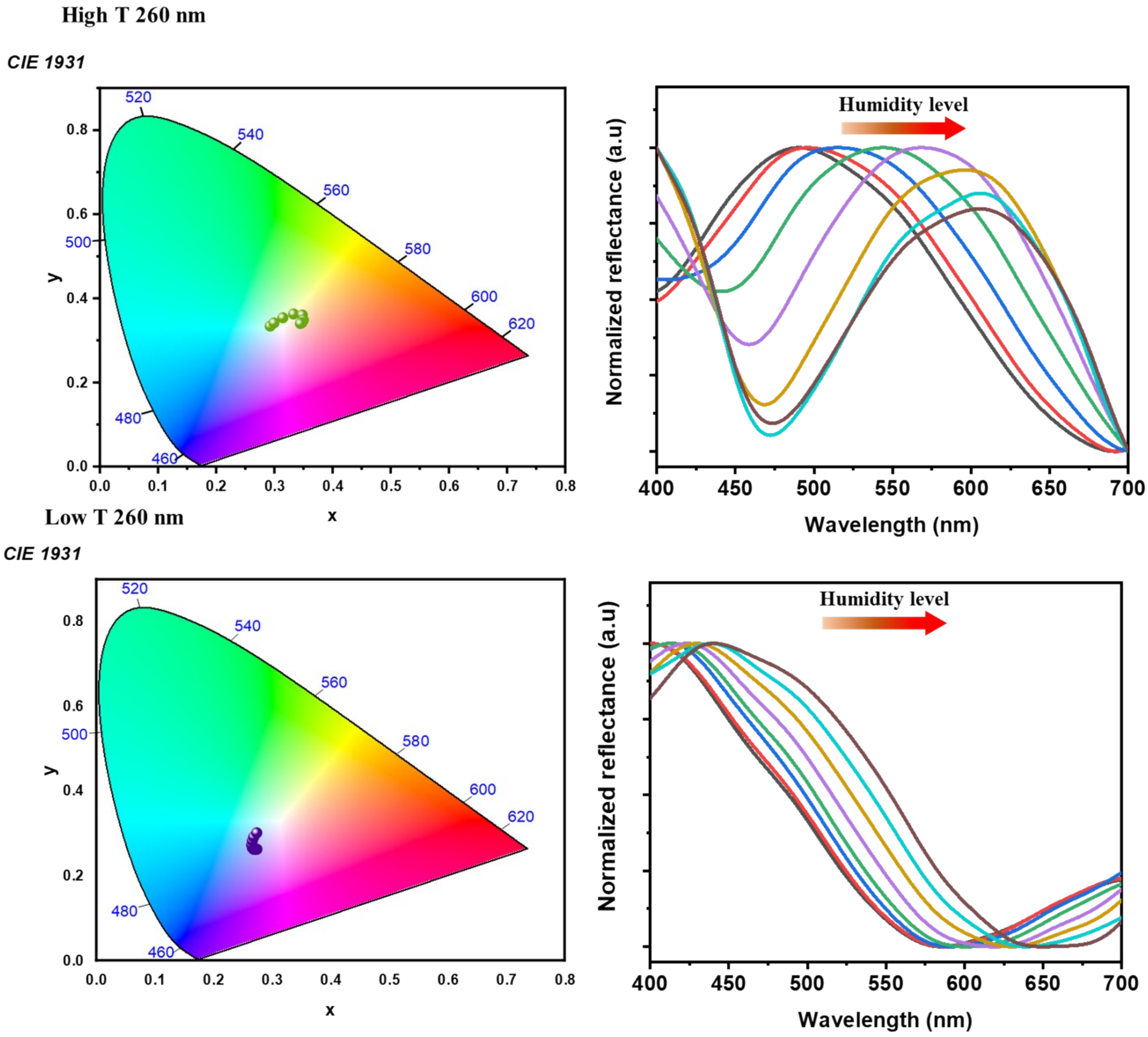

Figure S7. Chromaticity plots for RGB gamut on CIE coordinates show the distinct color generation from the barcode-like sensor at each area: High T 260 nm, Low T 260 nm