Supporting information for:

Optical Interference-Based Sensors for Visual Detection of Nano-Scale Objects

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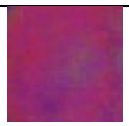
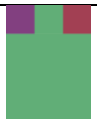
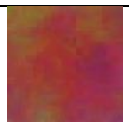
1. Color modeling

Color for each film thickness was modeled according to **Equation 1** (**Table S1**). Each wavelength was transformed into HEX color by software URL: https://academo.org/demos/wavelength-to-colour-relationship/. For thicknesses that form color combined from two or more wavelengths was used software URL: https://www.imgonline.com.ua/color-mixing.php to mix up needed colors.

Table S1. Color modeling according to Equation 1.

Thickness, nm	Wavelength, nm	Photo	Color	HEX
100	400±50 nm;			0046ff
150	600±60 nm;			ffbe00
200	800±70 nm and 400±30 nm;			c1005b
250	510±30 nm and ~360 nm;			4280a4
300	600±45 nm and 400±30 nm;			c15f5b
350	700±50 nm and 470±35 nm;			806080
400	~750 nm and 530±35 nm and 400±20 nm;			94405b
450	600±40nm and 450±30 nm;			808280
500	670±40 nm and 500±30 nm and 400±25 nm;			61af77
550	730±40 nm and 550±30 nm and 440±25 nm;			a95240

2. *SEM, TEM images of inkjet printed titania spot.*

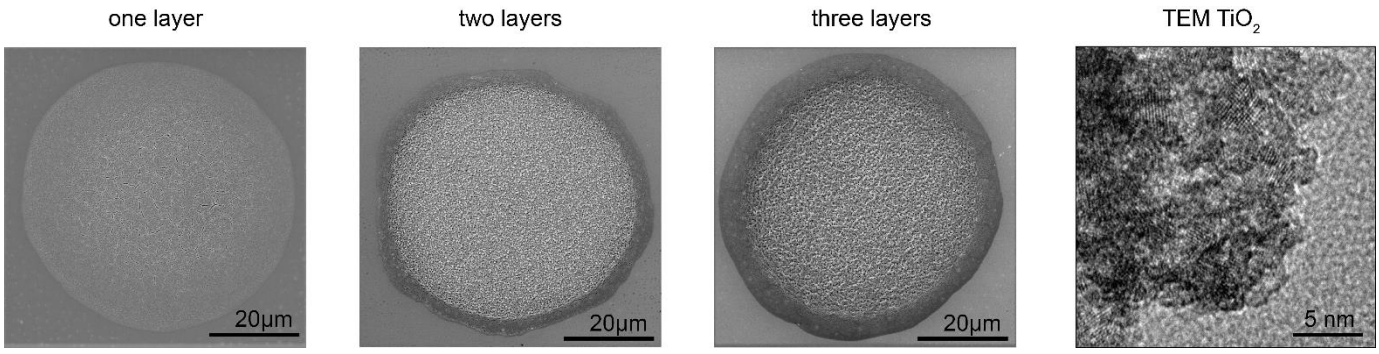


Figure S1 SEM pictures of printed TiO_2 spots having different thickness. TEM image of titania nanoparticles after ink deposition.

3. *Detection of AlOOH nanoparticles and Escherichia coli bacteria by interference-based biosensors*

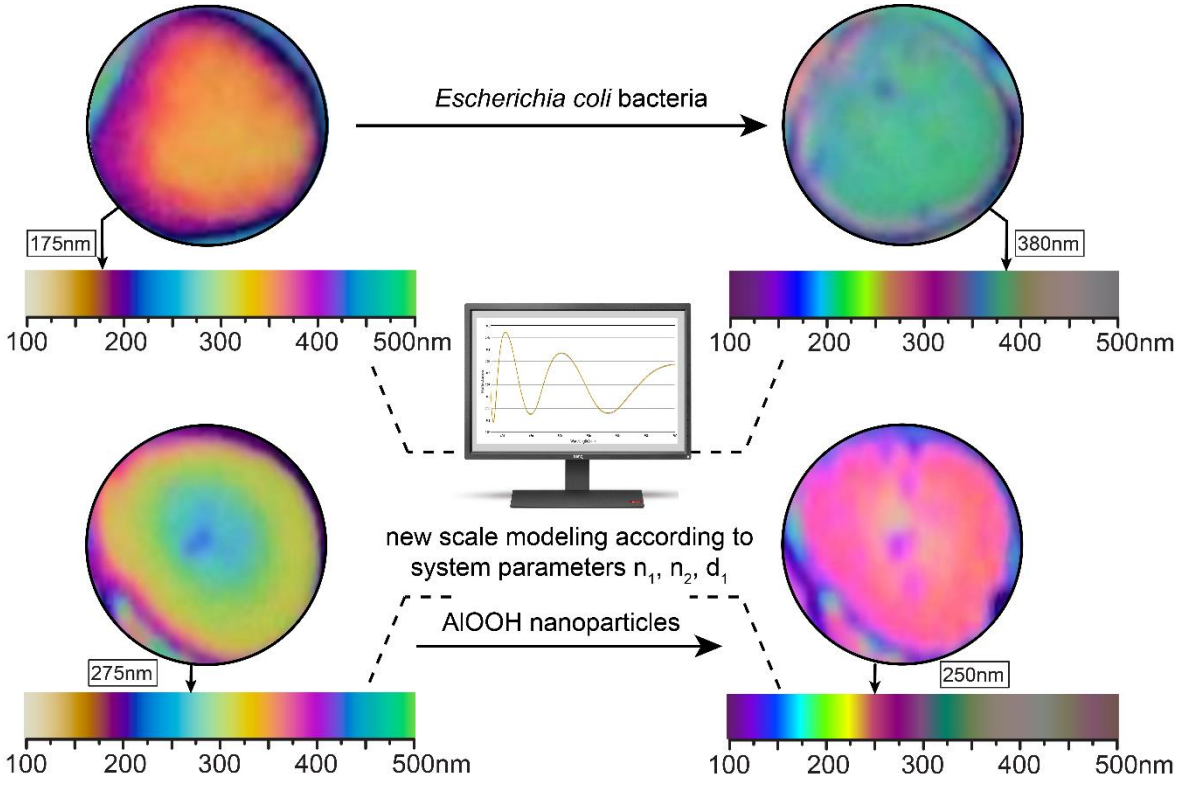


Figure S2 Scheme of color scale forming and color change after adsorption of AlOOH nanoparticles and Escherichia coli bacteria.

The color scale for each system was calculated independently according to the system parameters such as thickness of sensor layer and refractive indexes of all system components. For modeling was used software URL: https://www.filmetrics.com/reflectance-calculator.

4. Optical measurements

Microphotography followed with digital color analysis (DCA) of the spots was performed by the video microscope (positioning range 5 × 5 mm, positioning step 0.3 μm, resolution 2 μm) build into atomic force microscope (Solver Next, P9 XPM Systems Digital Control Platform). The images were processed with the ImageJ freeware (http://rsbweb.nih.gov/ij/). Experimental data processing was performed using Origin-Pro 9.0.

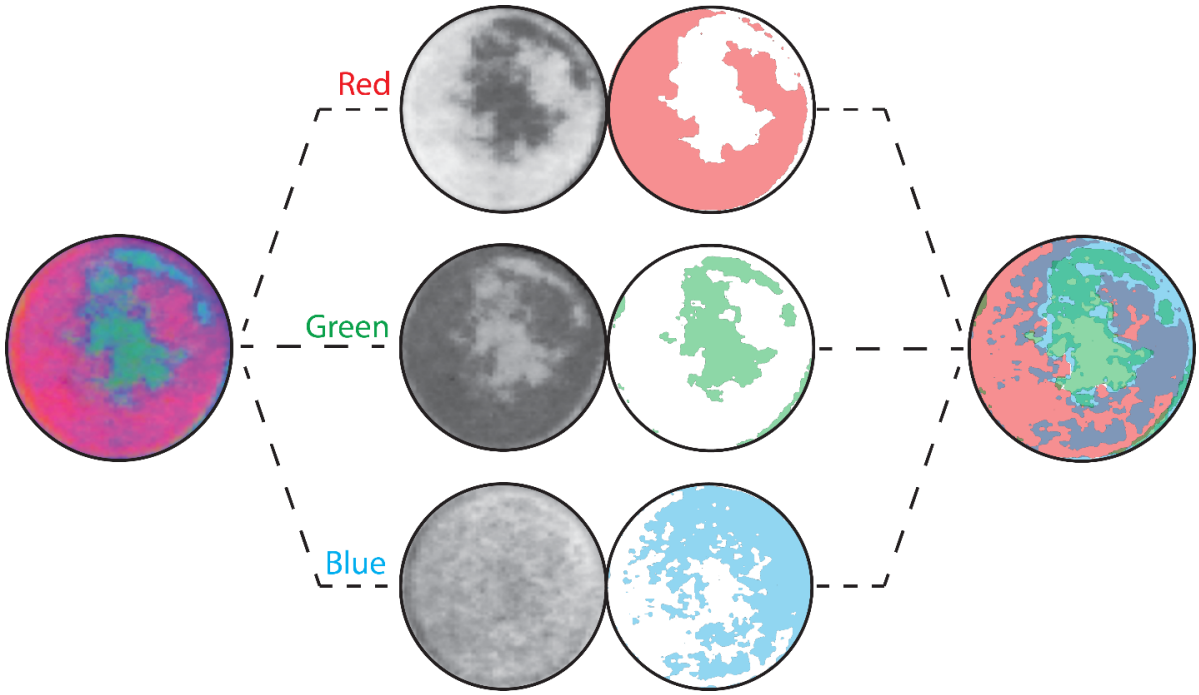


Figure S3 Scheme of RGB color separation method.

5. *Antibacterial test*

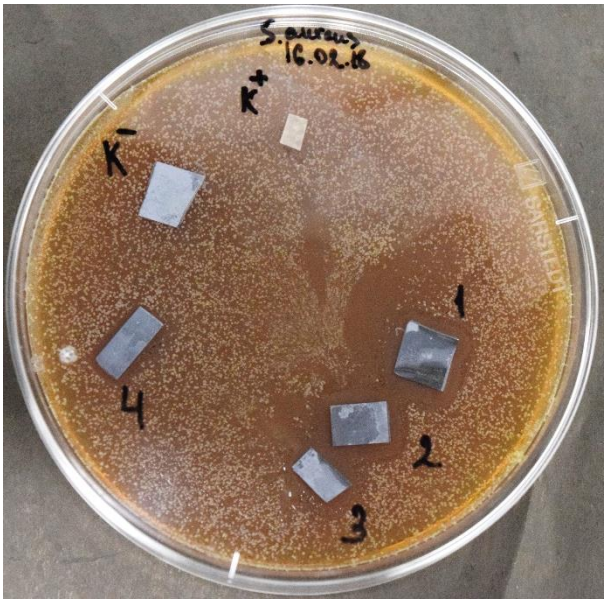


Figure S4 Bacteriolytic effect of the bacteriophage adsorbed on the printed spots on *Staphylococcus aureus* 209 P sensitive to it. 1-4 – a substrates with different amount of printed spots after bacteriophage adsorption (0.027 g/ml), K^- – substrate with printed spots without bacteriophages, K^+ – filter paper soaked in a solution of bacteriophages of the same concentration.

6. Comparison of developed approach with other methods

Table S2 Comparison with other methods for detection of nano-objects

Method	*Principle*	*Accompanying equipment*	*Selectivity*	*Sensitivity*	*Guide price*
Photoacoustic flow cytometry[2]	photoacoustic effect	+	+	ultra high	very expensive
Whispering gallery microlasers[3]	light scattering	+	-	high	expensive
Graphene /quantum dots POC device[6]	fluorescence	+	+	high	expensive
Sensor array with gold nanoparticles[8]	coloring effect	-	+	medium	cheap
Interference-based sensors (this paper)	interference	-	to be improved	medium	very cheap

7. Additional characterization

The viscosity parameters were studied using a Fungilab EXPERT L rotary viscometer. The measurements were carried out using an L1 spindle at a rotation speed of 100 rpm. The maximum achieved value of the sample viscosity was 60 mPa s.

The surface tension was measured using the drop shape analyzer KRUSS DSA-25.

The zeta potential and size distribution in a solution were measured with a Photocor Compact-Z analyzer at 25 °C, scattering angle of 90° with TEC stabilized diode laser 638 nm, 25 mW.

In order to evaluate the surface morphology of printed spots, surface imaging was conducted in tapping mode in air using the NT-MDT Solver Next AFM. The used cantilevers were NT-MDT spectrum instruments (HA-NC) with nominal spring constants of 12 Nm^{-1}. Typical scan size was

80 × 80 μm with 512 × 512 sampling points. Image processing was performed by NT-MDT SPM software Image analysis.

Low resolution SEM microscopy was taken on Tescan Vega 3 microscope.

The samples for transmission electron microscopy (TEM) were prepared by dispersing small amounts of samples in ethanol to form a homogeneous suspension.