Supplementary Information

Poly(vinyl alcohol)-assisted synthesis of 3D Bi_2S_3 submicrometric structures toward feasible chip photodetector applications

Krystian Mistewicz[1], Marcin Godzierz[2,*], Anna Gawron[2], Łukasz Otulakowski[2], Anna Hercog[2,3], Klaudia Kurtyka[2], Sugato Hajra[4], Hoe Joon Kim[4]

[1] Silesian University of Technology, Institute of Physics – Center for Science and Education, Krasińskiego 8 Str., 40-019 Katowice, Poland; krystian.mistewicz@polsl.pl

[2] Centre of Polymer and Carbon Materials, Polish Academy of Sciences, Curie-Skłodowskiej 34 Str., 41-819 Zabrze, Poland; mgodzierz@cmpw-pan.pl, agawron@cmpw-pan.pl, lotulakowski@cmpw-pan.pl, ahercog@cmpw-pan.pl, kkurtyka@cmpw-pan.pl

[3] SPIN-Lab Centre for Microscopic Research on Matter, University of Silesia in Katowice, 75 Pułku Piechoty 1 str., 41-500 Chorzów, Poland; anna.hercog@us.edu.pl

[4] Department of Robotics and Mechatronics Engineering, Daegu Gyeongbuk Institute of Science and Technology, Daegu 42988, Republic of Korea; sugatohajra@dgist.ac.kr, joonkim@dgist.ac.kr

* corresponding author: mgodzierz@cmpw-pan.pl

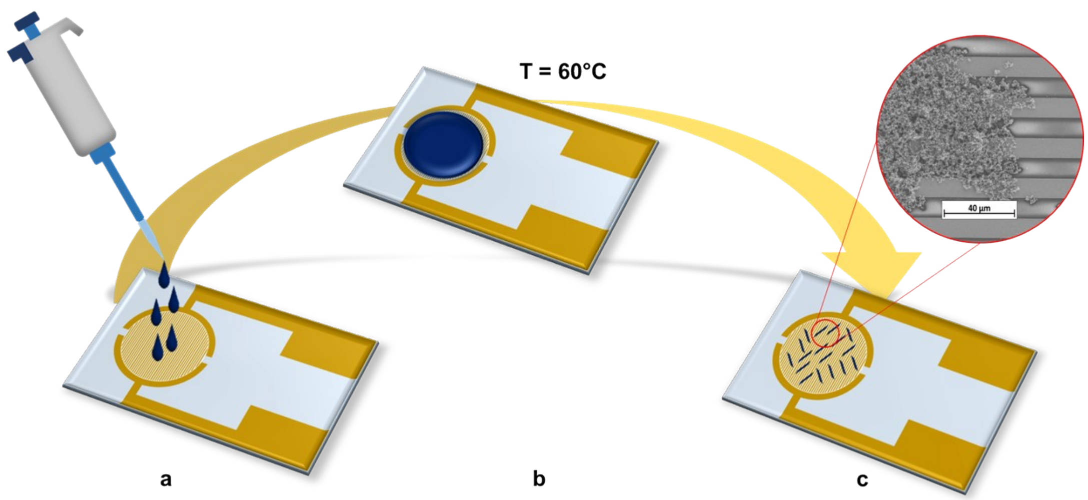

Fig. S1. Scheme of photodetector fabrication process: (a) drop-casting of Bi_2S_3 dispersion in ethanol onto ED-IDE1-Au chip, (b) solvent evaporation at 60°C, and (c) final chip-based photodetector with deposited particles. An inset in figure (c) shows SEM micrograph of the Bi_2S_3 (BS-PVA$_{high}$ sample) deposited on the ED-IDE1-Au chip.

Table S1. A comparison of the energy band gaps of BS, BS-PVA_{low}, and BS-PVA_{high} samples with literature data for Bi_2S_3 (used abbreviations: T – theoretical computations performed using first principle Density Functional Theory (DFT), E – experimental method of energy band gap determination based on UV-VIS spectroscopy).

Material	**Method of material preparation**	**Energy band gap value**, eV	**Band gap type**	**Determination method**	**Ref.**
Bi_2S_3 film	atomic layer deposition	1.03	indirect	E	[1]
Bi_2S_3	not applicable	1.32	indirect	T	[2]
Bi_2S_3 film	physical vapor deposition	1.32 – 1.36		E	[3]
Bi_2S_3 film	reactive evaporation	1.38	direct	E	[4]
Bi_2S_3 nanoflowers	hydrothermal method	1.39	direct	E	[5]
Bi_2S_3 film	electrochemical synthesis	1.4	direct	E	[6]
Bi_2S_3 nanosheets	hydrothermal vulcanization	1.41	direct	E	[7]
Bi_2S_3 nanocrystals	organometallic synthesis	1.443		E	[8]
Bi_2S_3 nanowires	hydrothermal vulcanization	1.46	direct	E	[7]
Bi_2S_3 nanoribbons	hydrothermal vulcanization	1.47	direct	E	[7]
Bi_2S_3	not applicable	1.492	indirect	T	[9]
Bi_2S_3 film	atomic layer deposition	1.56	direct	E	[1]
Bi_2S_3 film	chemical bath deposition	1.56	direct	E	[10]
Bi_2S_3 film	successive ionic layer adsorption and reaction	1.61	direct	E	[11]
Bi_2S_3 film	pulse-plating method	1.68	direct	E	[12]
BS	microwave synthesis	1.34(2)	direct	E	this work
BS-PVA_{high}	PVA-assisted microwave synthesis	1.41(1)	direct	E	this work
BS-PVA_{low}	PVA-assisted microwave synthesis	1.43(3)	direct	E	this work

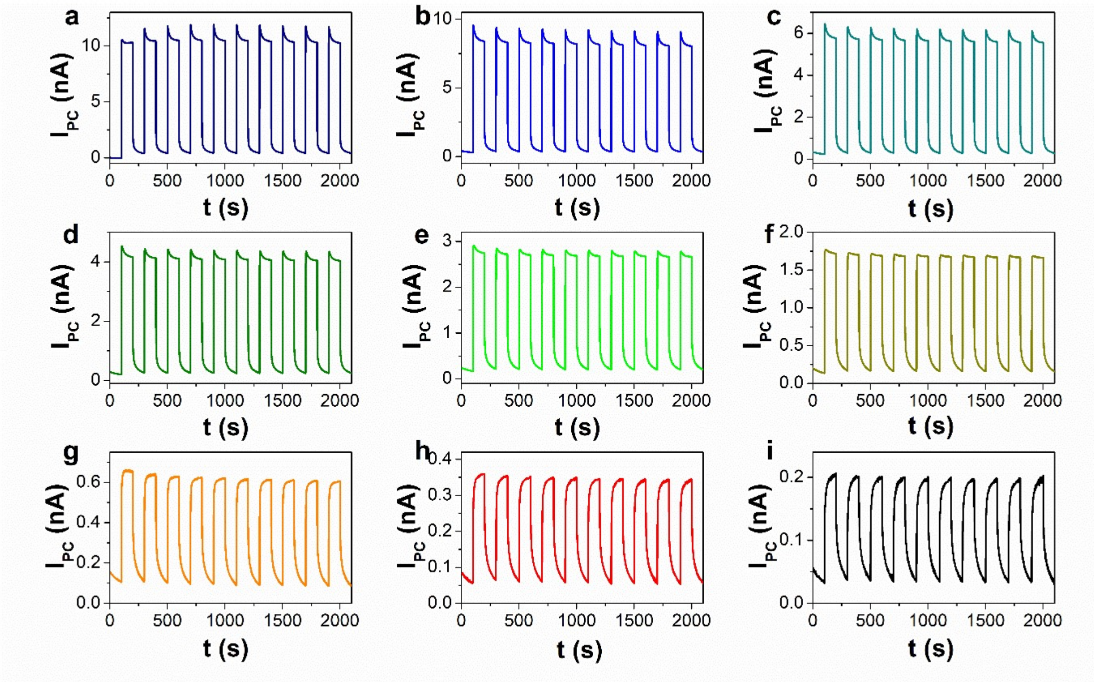

Fig. S2. The transient photocurrent responses of Bi_2S_3 nanosheets (BS-PVA$_{high}$ sample) to switching ON and OFF green light illumination (λ=517 nm) measured for different light intensities (a) I_L=915 µW/cm^2, (b) I_L=619 µW/cm^2, (c) I_L=323 µW/cm^2, (d) I_L=183 µW/cm^2, (e) I_L=86 µW/cm^2, (f) I_L=36 µW/cm^2, (g) I_L=5.9 µW/cm^2, (h) I_L=2.3 µW/cm^2, (i) I_L=0.95 µW/cm^2 (U=1 V, T=20°C, RH=30%).

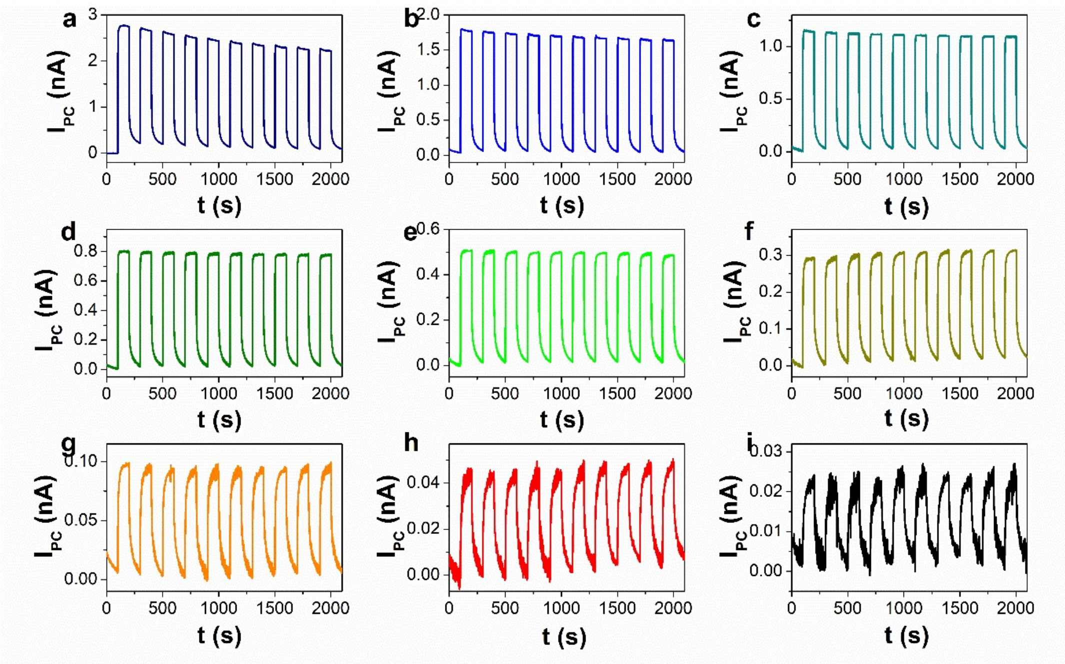

Fig. S3. The transient photocurrent responses of Bi_2S_3 nanosheets (BS-PVA$_{high}$ sample) to switching ON and OFF red light illumination (λ=628 nm) measured for different light intensities (a) I_L=332 µW/cm^2, (b) I_L=202 µW/cm^2, (c) I_L=92 µW/cm^2, (d) I_L=48 µW/cm^2, (e) I_L=20 µW/cm^2, (f) I_L=7.7 µW/cm^2, (g) I_L=0.98 µW/cm^2, (h) I_L=0.34 µW/cm^2, (i) I_L=0.13 µW/cm^2 (U=1 V, T=20°C, RH=30%).

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