Electronic Supplementary Material (ESI) for Materials Horizons.

Angle-Independent Solar Radiation Capture by 3D Printed Lattice Structure for Efficient Photoelectrochemical Water Splitting

Chidanand Hegde,[ab] Tamar Rosental,[c] Joel Ming Rui Tan,[ab] Shlomo Magdassi*[bc] and Lydia Helena Wong*[ab]

[a] Department of Materials Science and Engineering, Nanyang Technological University, Singapore 639798
Email:

[b] Singapore-HUJ Alliance for Research and Enterprise (SHARE), Campus for Research Excellence and Technological Enterprise (CREATE) Singapore 138602

[c] Casali Center for Applied Chemistry, Institute of Chemistry, Center for Nanoscience and Nanotechnology, The Hebrew University of Jerusalem, Jerusalem, Israel 91904

*Corresponding authors: lydiawong@ntu.edu.sg, magdassi@mail.huji.ac.il

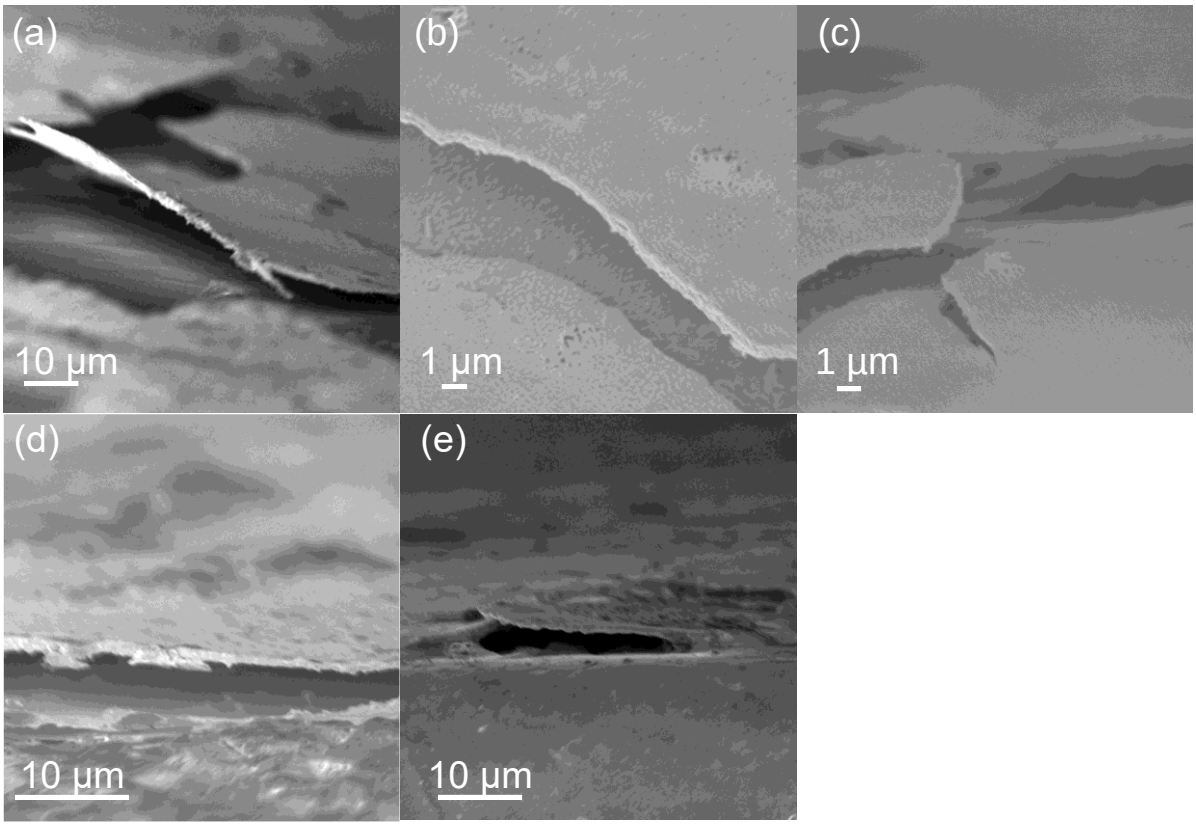

Fig. S1 FESEM cross section images of the (a) 2*2, (b) 3*3, (c) 4*4, (d) 5*5, and (e) 6*6 lattices to estimate the approximate thickness of the ITO/$BiVO_4$ coating. Imaging of the cross-section view is difficult due to curved cross section of the cut glasses from the 3D lattice, hence the images of the flakes coming off the surface are taken to estimate the cross-section thickness.

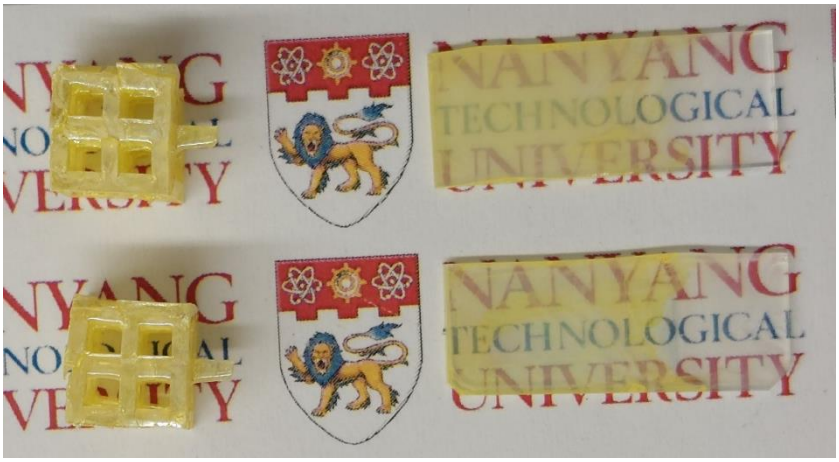

Fig. S2 Optical images of the 3D printed and glass substrates coated with ITO and Mo-$BiVO_4$.

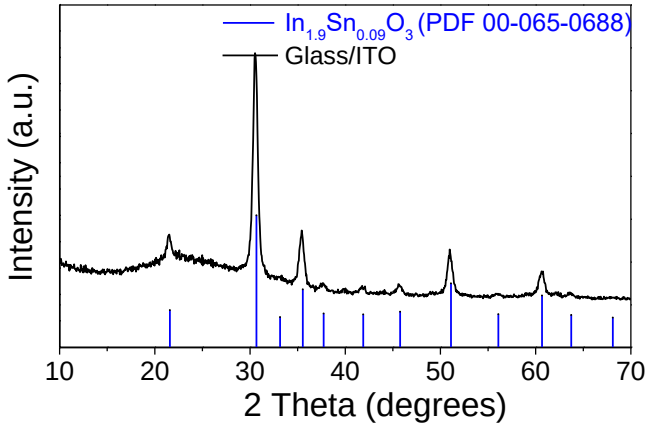

Fig. S3 X-ray diffraction spectra of Glass/ITO. (ITO here is the dip coated and annealed)

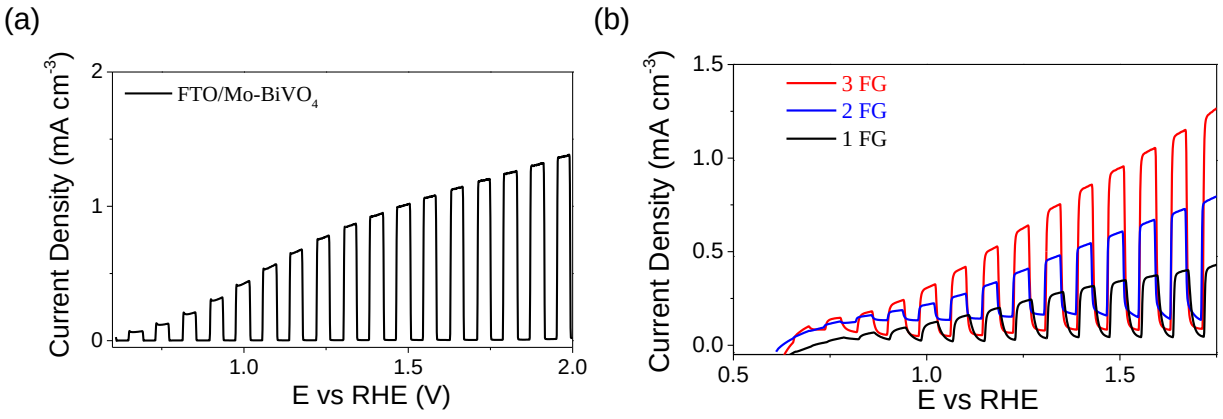

Fig. S4 Comparison of linear sweep voltammetry curves of (a) commercial FTO glass with dip coated Mo-$BiVO_4$ against, (b) different number of flat glass samples dip coated bifacially with ITO and Mo-$BiVO_4$ in series (assembled on behind another) for electrochemical water oxidation under chopped illumination. (1 FG refers to 1 flat glass sample and so on)

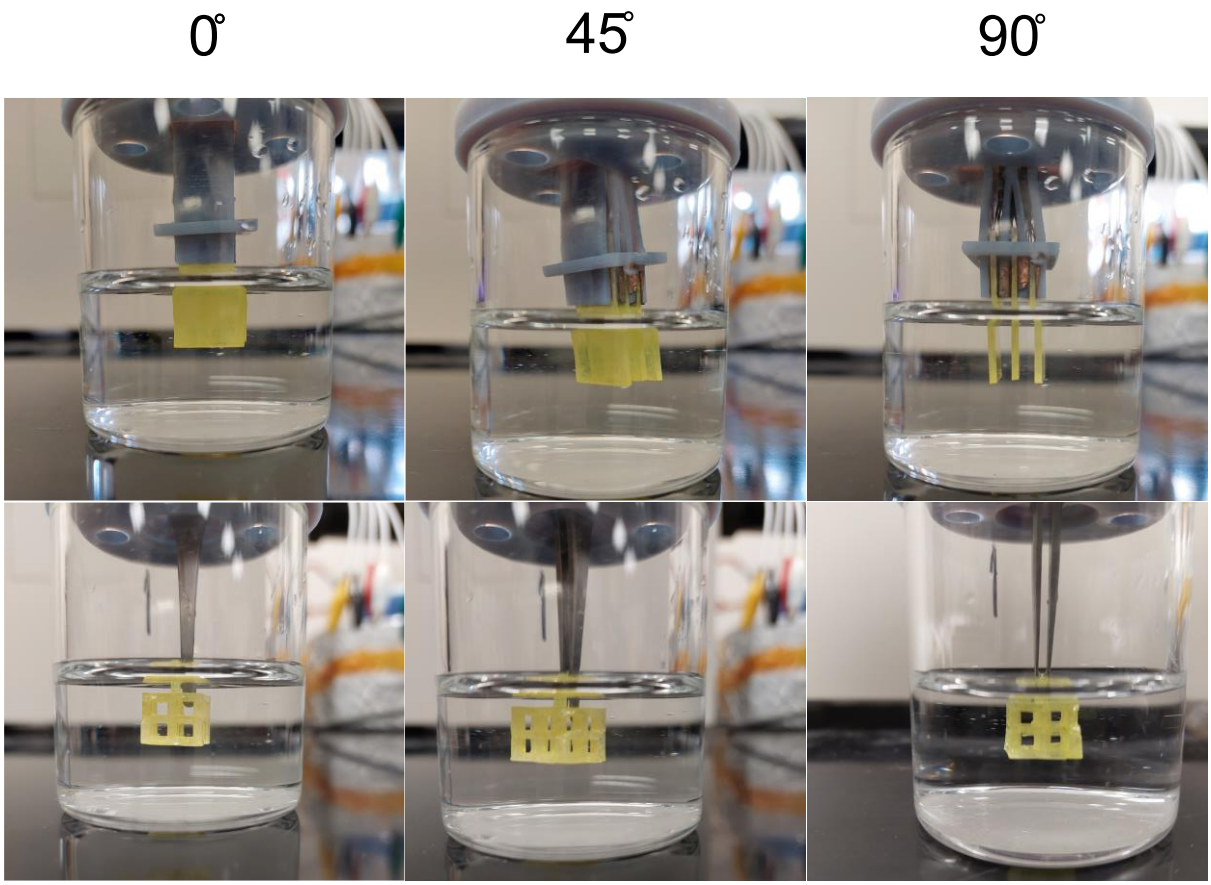

Fig. S5 Pictures of 3FG/ITO/Mo-$BiVO_4$ and 3DP/ITO/Mo-$BiVO_4$ electrode setup used for measuring the photocurrent density with varying illumination angle. The 0-degree orientation refers to when the flat glass surface is fully exposed to light, and a minimal exposure at 90 degrees illumination.

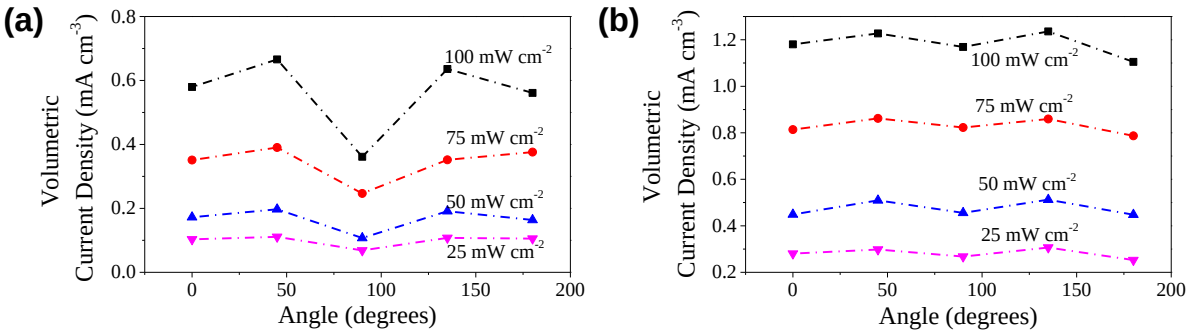

Fig. S6 Plot of volumetric current density vs angle of illumination at different light intensities for (a) 3FG sample, (b) 3D printed (3*3) lattice.

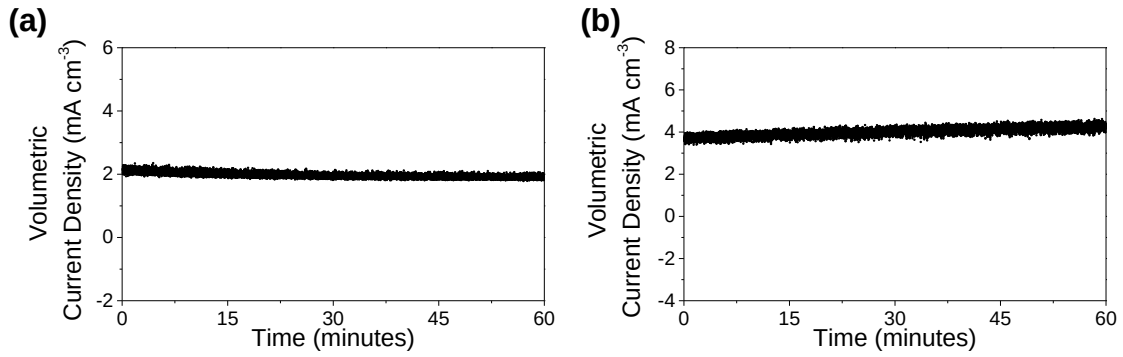

Fig. S7 Plot to investigate the variation of volumetric current density with time at 2 V for (a) 3FG sample, (b) 3DP (3*3) lattice for 60 minutes. The test was conducted with constant stirring of the electrolyte in both cases.

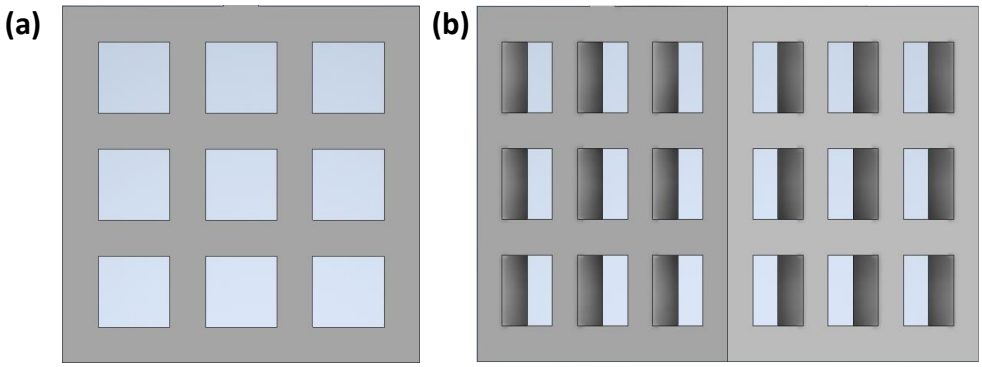

Fig. S8 Figure showing the orthogonal projected area of the 3D lattice (a) at 0 degrees, (b) at 45 degrees. The grey color represents the projected area and the blue color represents the excluded area.

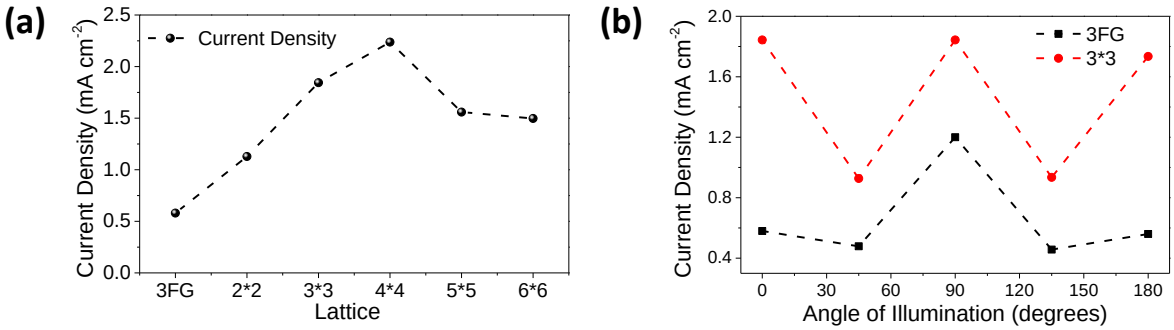

Fig. S9 (a) Comparison of current density based on orthogonally projected area at 1.23 V for various 3D printed lattices and 3FG sample, (b) plot of current density based on orthogonally projected area of 3D printed (3*3) lattice and 3FG sample at 1.23 V at various angles of illumination.

Table S1 List of the measured values of sheet resistance in ohms/sq. for a different number of dip coatings and for various concentrations of the solution.

	2 Coats	**3 Coats**	**4 Coats**	**5 Coats**
0.1 M	100000	78000	54000	16000
0.2 M	38000	19000	7000	2700
0.3 M	10450	4780	3800	1440
0.4 M	4350	1600	690	340

Table S2 List of the measured values of optical transmittance percentage at 550 nm for a different number of dip coatings and for various concentrations of the solution.

	2 Coats	**3 Coats**	**4 Coats**	**5 Coats**
0.1 M	99.5	98.4	97.6	95
0.2 M	96.34	96.7	93.5	90
0.3 M	95.5	92.3	90.5	84.9
0.4 M	93.5	90.3	87	82