Supplementary Information

Plastic Based Dye-Sensitized Solar Cell Using the Co₉S₈ Acicular Nanotube Arrays as the Counter Electrode

Hsin-Wei Chen,^a Chung-Wei Kung,^a Chuan-Ming Tseng,^b Tzu-Chien Wei,^c Nobuya Sakai,^d Saori Morita,^d Masashi Ikegami,^d Tsutomu Miyasaka^{*d} and Kuo-Chuan Ho^{*a, e}

^aDepartment of Chemical Engineering, National Taiwan University, Taipei 10617, Taiwan

^bInstitute of Physics, Academia Sinica, Taipei 11529, Taiwan

^cDepartment of Chemical Engineering, National Tsing Hua University, Hsin-Chu 30013, Taiwan ^dGraduate School of Engineering, Toin University of Yokohama, 1614 Kurogane-cho, Aoba, Yokohama, Kanagawa 225-8502, Japan

^eInstitute of Polymer Science and Engineering, National Taiwan University, Taipei 10617, Taiwan



Fig. S1 Cross-sectional SEM images of LCCH ANRAs obtained from (a) 90 min, (b) 120 min,

(c)150 min, and (d) 180 min of the CBD process.



Fig. S2 (a) Schematic illustration for the formation of Co_9S_8 acicular nanotube from the LCCH acicular nanorod based on the Kirkendall effect. TEM images of a (b) LCCH acicular nanorod, (c) core-shell of LCCH acicular nanorod (core) and Co_9S_8 nanotube (shell), and (d) Co_9S_8 acicular nanotube.



Fig. S3 (a) TEM image of a LCCH acicular nanorod, (b) EDS elemental mapping image for Co (red points), (c) O (green points) and (d) S (yellow points).



Fig. S4 (a) TEM image of a Co_9S_8 acicular nanotube, (b) EDS elemental mapping image for Co (red points), (c) O (green points) and (d) S (yellow points).



Fig. S5 (a) photo of the Co_9S_8 ANTAs-150 min thin film (upper) and sputtered Pt electrode (lower), (b) photo of the whole devices of the Co_9S_8 ANTAs-150 min thin film (upper) and sputtered Pt electrode (lower), (c) photo of DSSC bended with different angles, (d) J-V curves of DSSCs bended with different angles and (e) normalized conversion efficiency for DSSCs against bending angle for Co_9S_8 ANTAs-150 min and sputtered Pt CEs.

Angle (degree)	$V_{OC}(V)$	J_{SC} (mA cm ⁻²)	FF	η (%)
0	0.68	10.74	0.69	5.05
30	0.68	10.73	0.67	4.91
45	0.67	10.44	0.66	4.65
60	0.66	10.12	0.66	4.42
90	0.65	10.08	0.65	4.20

Table S1. Photovoltaic parameters of the DSSCs with CE of Co_9S_8 ANTAs-150 min bended with different angles under illumination of 100 mW cm⁻².

Table S2. Photovoltaic parameters of the DSSCs with CE of sputtered Pt bended with different angles under illumination of 100 mW cm⁻².

Angle (degree)	$V_{OC}(V)$	J_{SC} (mA cm ⁻²)	FF	η (%)	
0	0.68	11.54	0.67	5.26	
30	0.68	11.44	0.67	5.22	
45	0.67	11.27	0.67	5.11	
60	0.67	11.06	0.67	5.01	
90	0.67	10.95	0.66	4.93	