Supplementary Information

Nanostructured shuriken-like $BiVO_4$ with preferentially exposed {010} facets: preparation, formation mechanism, and enhanced photocatalytic performance

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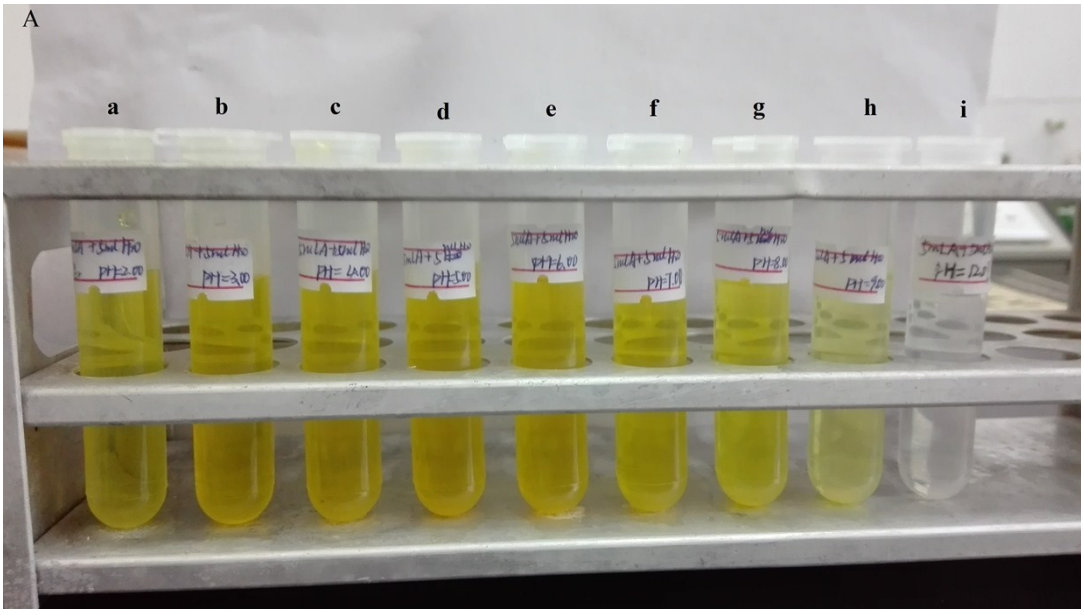
1. Preparation of mixed solution of sodium vanadate solution and glycerol solution

0.625 mmol $Na_3VO_4·12H_2O$ was dissolved into 50 mL distilled water to form Na_3VO_4 solution A with a concentration of 0.0125 mol/L. At this point, the pH value of the unregulated solution A was tested to be 12.01, which was denoted as $A_{12.01}$. Similar with the above process, another nine independent Na_3VO_4 solutions with the concentration of 0.0125 mol/L were prepared by dissolving 0.625 mmol $Na_3VO_4·12H_2O$ into 50 mL HNO_3 or NaOH solution. The pH values of the nine Na_3VO_4 solutions were adjusted to 2, 3, 4, 5, 6, 7, 8 and 9, respectively, and the corresponding solutions were named as A_2, A_3, A_4, A_5, A_6, A_7, A_8 and A_9, respectively. The photographs of the series of A are shown in Fig. S1A.

12.5 mL glycerol (Gly) and 87.5 mL distilled water were mixed to form Gly solution G with the volume fraction of 12.5%. The pH value of the unregulated solution G was tested to be 6.78, which

was denoted as $G_{6.78}$. Another nine independent 12.5 mL Gly were mixed respectively with 87.5 mL HNO_3 or 87.5 mL NaOH solution to prepare Gly solution with the volume fraction of 12.5%. The pH values of the nine Gly solutions were adjusted to 2, 3, 4, 5, 6, 7, 8 and 9, respectively, and the corresponding solutions were named as G_2, G_3, G_4, G_5, G_6, G_7, G_8 and G_9, respectively. The photographs of the series of G are shown in Fig. S1B.

The series of solution A and solution G which have the same pH values were mixed in the same volume to obtain the mixed solution of Na_3VO_4 solution and Gly solution. The as-prepared mixed solutions were expressed as A_xG_x-y, where x expresses the pH value of solution A and solution G before mixing, and y represents the pH value of the mixed solution. For instance, A_2G_2-2.34 refers to the mixed solution prepared by mixing A_2 with equal volume of G_2, which pH value was tested to be 2.34. When the unregulated solution $A_{12.01}$ was mixed with $G_{6.78}$ in the same volume, the pH value of the mixture was tested to be 9.97, which was named as $A_{12.01}G_{6.78}$-9.97. Fig. S1C displays the photographs of the series mixture of A_xG_x-y and $A_{12.01}G_{6.78}$-9.97.



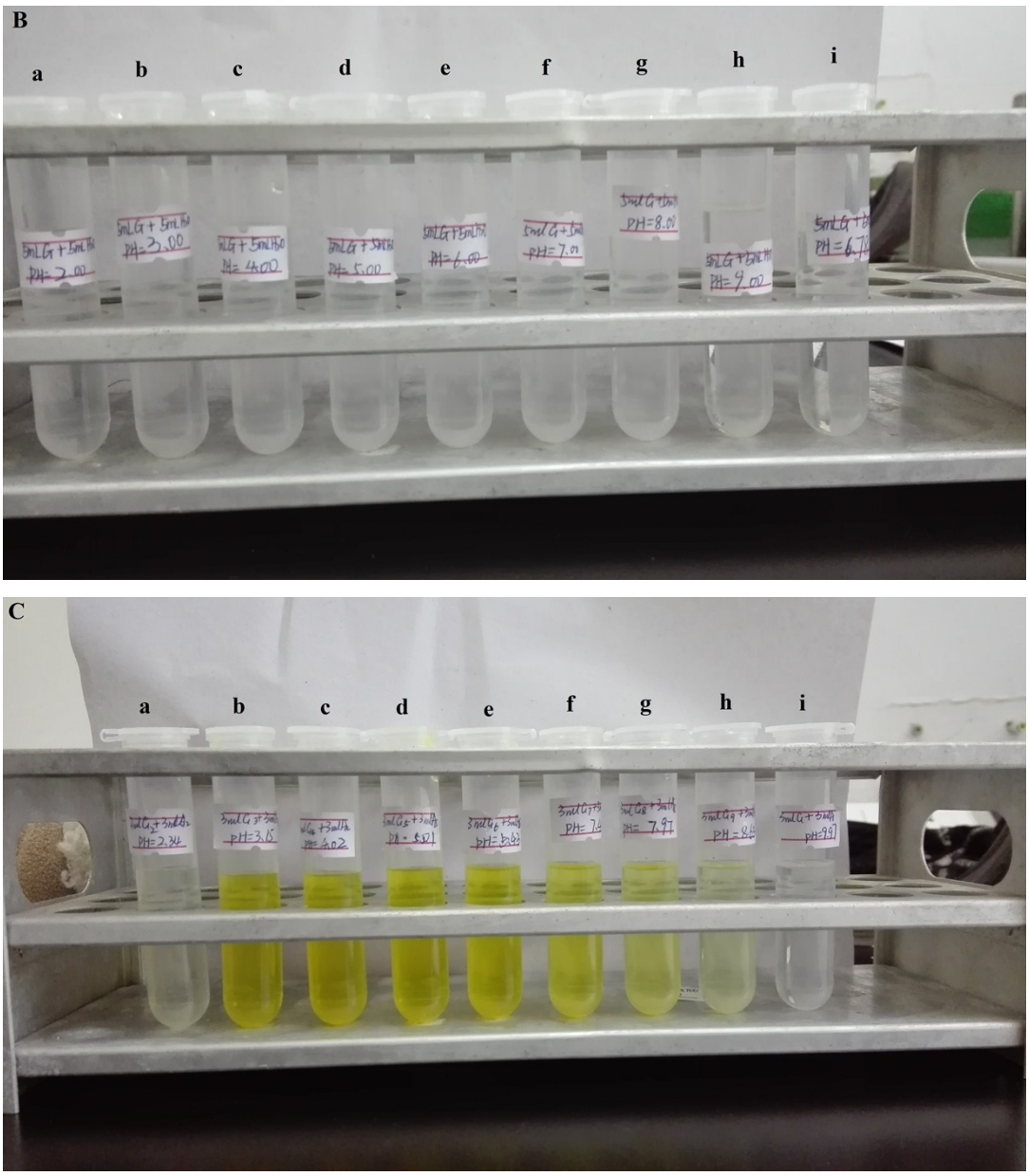


Fig. S1 (A) Photographs of the series of A. Note, a, b, c, d, e, f, g, h and i in this figure corresponding to A_2, A_3, A_4, A_5, A_6, A_7, A_8, A_9 and $A_{12.01}$, respectively.
(B) Photographs of the series of G. Note, a, b, c, d, e, f, g, h and i in this figure corresponding to G_2, G_3, G_4, G_5, G_6, G_7, G_8, G_9 and $G_{6.78}$, respectively
(C) Photographs of the series mixture of A_xG_x-y and $A_{12.01}G_{6.78}$-9.97. Note, a, b, c, d, e, f, g, h and i in this figure corresponding to A_2G_2-2.34, A_3G_3-3.15, A_4G_4-4.02, A_5G_5-5.01, A_6G_6-5.43, A_7G_7-7.43, A_8G_8-7.97, A_9G_9-8.65 and $A_{12.01}G_{6.78}$-9.97, respectively.

2. Preparation of mixed solution of sodium vanadate solution and ethylenediamine tetraacetic acid disodium solution

0.625 mmol ethylenediamine tetraacetic acid disodium (EDTA) was dissolved into 50 mL distilled water to form EDTA solution E with a

concentration of 0.0125 mol/L. At this point, the pH value of the unregulated solution E was tested to be 4.79, which was denoted as $E_{4.79}$. Similar with the above process, another eight independent EDTA solutions with the concentration of 0.0125 mol/L were prepared by dissolving 0.625 mmol EDTA into 50 mL HNO_3 or NaOH solution. The pH values of the eight solutions were adjusted to 3, 4, 5, 6, 7, 8 and 9, respectively, and the corresponding solutions were named as E_3, E_4, E_5, E_6, E_7, E_8 and E_9, respectively. In addition to that, when 0.625 mmol EDTA was dissolved into 50 mL HNO_3 solution and then adjusting the pH value to 2, the final status of the product was white suspension which was named as E_2. The photographs of the series of E are shown in Fig. S2A.

The series of solution A and solution E which have the same pH values were mixed in the same volume to obtain the mixed solution of Na_3VO_4 solution and EDTA solution. The as-prepared mixed solutuions were expressed as A_xE_x-z, where x expresses the pH value of solution A and solution E before mix, and z represents the pH value of the every mixed solution. For instance, A_3E_3-2.99 refers to the mixed solution prepared by mixing A_3 with equal volume of E_3, which pH value was tested to be 2.99. When the unregulated solution $A_{12.01}$ was mixed with $E_{4.79}$ in the same volume, the pH value of the mixture was tested to be 9.82, which was named as $A_{12.01}E_{4.79}$-9.82. After mixing A_2 and E_2, white solids are completely dissolved, and the mixed solution of Na_3VO_4 solution and EDTA suspension were obtained, which pH value was tested to be 2.07, and accordingly named as A_2E_2-2.07. Fig. S2B displays the photographs of the series mixture of A_xE_x-z and $A_{12.01}E_{4.79}$-9.82.

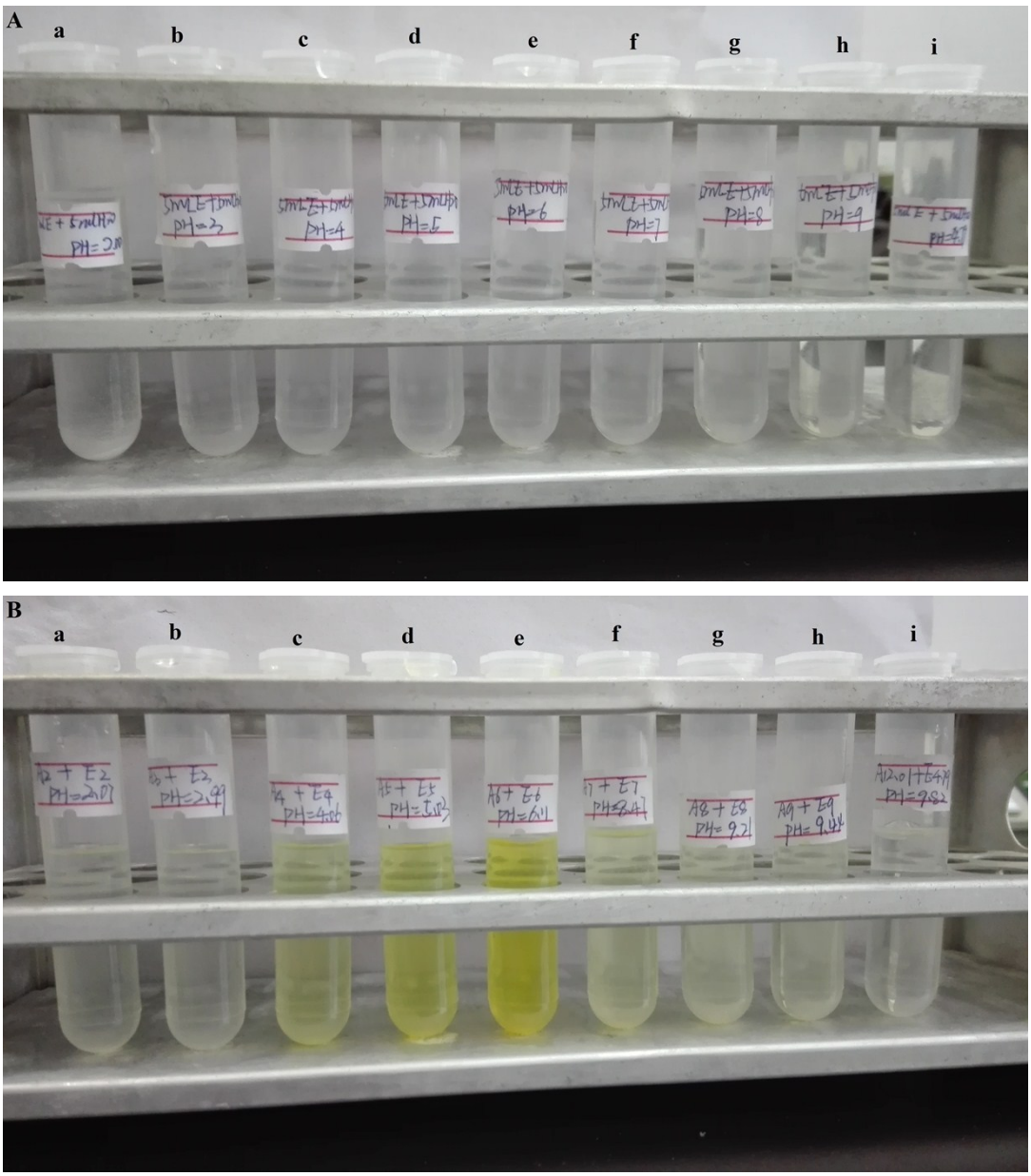


Fig. S2 (A) Photographs of the series of E. Note, a, b, c, d, e, f, g, h and i in this figure corresponding to E_2, E_3, E_4, E_5, E_6, E_7, E_8, E_9 and $E_{4.79}$, respectively.
(B) Photographs of the series mixture of A_xE_x-z and $A_{12.01}E_{4.79}$-9.82. Note, a, b, c, d, e, f, g, h and i in this figure corresponding to A_2E_2-2.07, A_3E_3-2.99, A_4E_4-4.06, A_5E_5-5.03, A_6E_6-6.11, A_7E_7-8.47, A_8E_8-9.21, A_9E_9-9.44 and $A_{12.01}E_{4.79}$-9.82, respectively.