Supplementary Information

Highly efficient visible-light-driven photoelectrocatalytic selective aerobic oxidation of biomass alcohols to aldehydes

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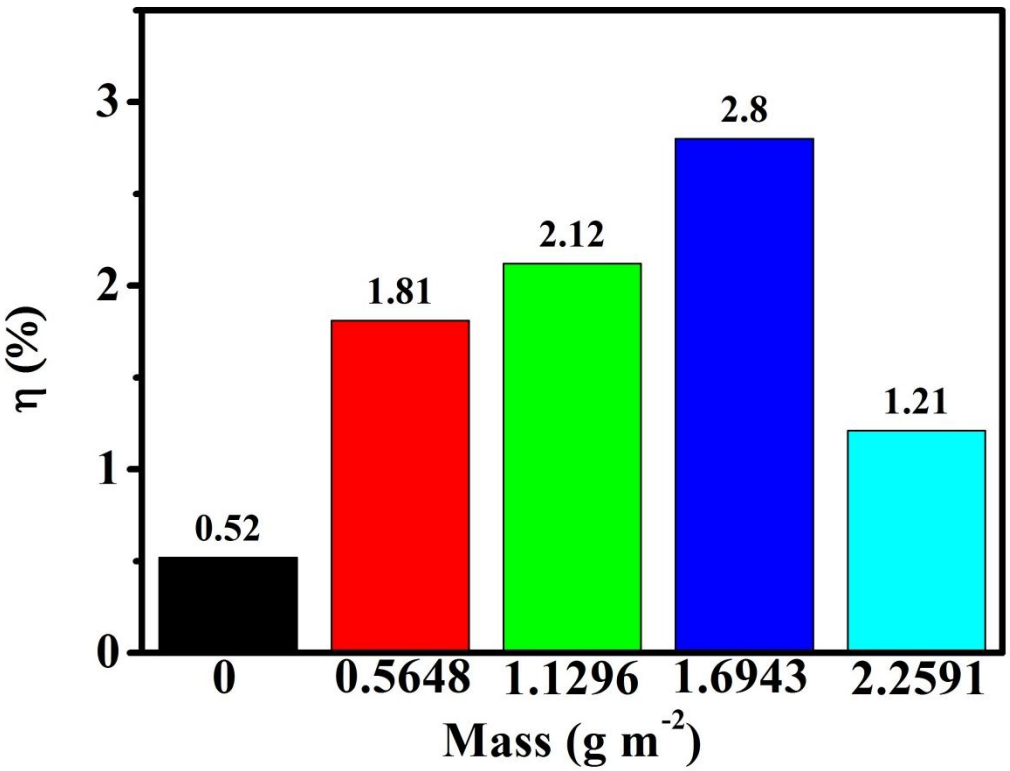
Preparation of TiO_2 NTs

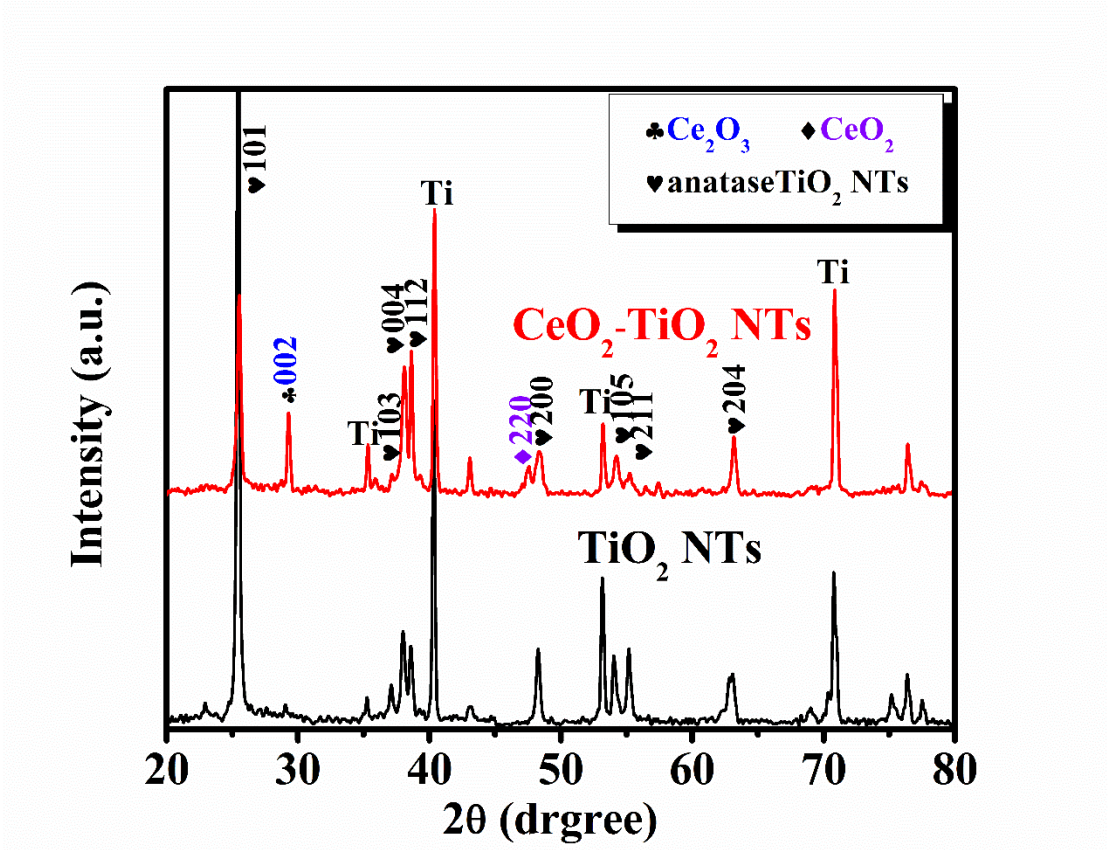
Highly ordered TiO_2 NTs were prepared by electrochemical anodic oxidation of Ti sheets in a two-electrode cell according to the literature.[33] Ti sheets were pretreated by mechanical polishing and ultrasonic washing in twice-distilled water and acetone, respectively. During the anodization process, pretreated Ti sheet was anodized at the applied voltage of 60 V with Pt foil serving as the counter electrode for 2 h at 25 ℃. The electrolyte consisted of 0.3 wt % NH_4F and 2.0 vol % H_2O in ethylene glycol. Then, the anodized TiO_2 NTs samples were rinsed with water and ethanol successively and were dried at 50 ºC for subsequent use.

Preparation of Au (λ_{534nm})/CeO_2/Ti photocathode

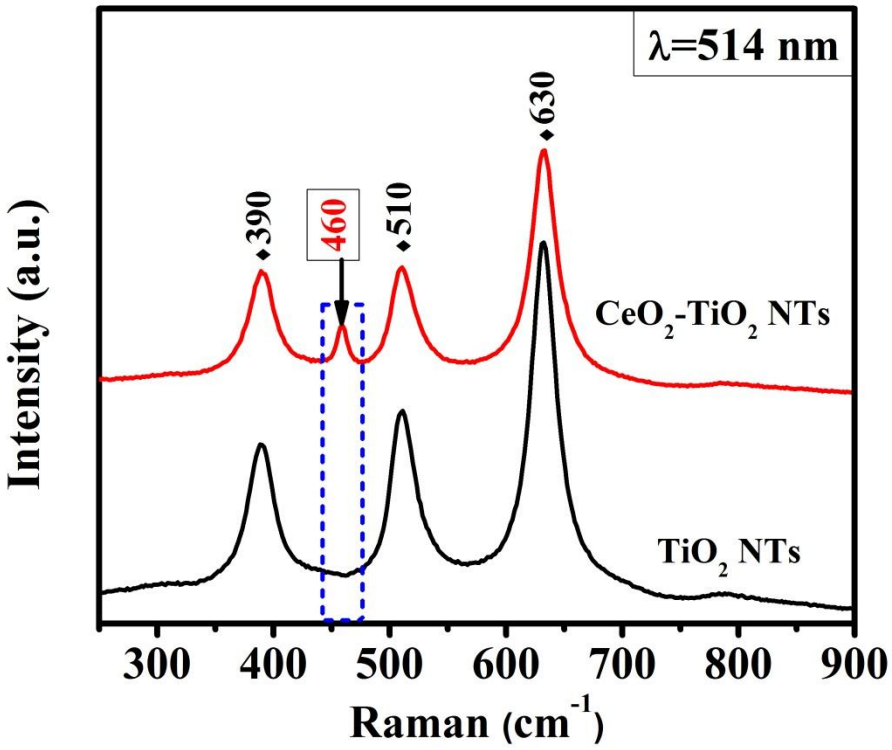
Ti sheets were pretreated by mechanical polishing and ultrasonic washing in twice-distilled water and acetone, respectively. Prior to electrodeposition, the Ti sheets were immersed in the deposition solution (0.1 mol L^{-1} $CeCl_3$ ethanol solution) for 1 h. The electrodeposition quality of CeO_2 onto the Ti substrate was the same as the deposition of CeO_2 onto the TiO_2 NTs (about1.6943 g m^{-2}), and the electrodeposition time was about 18s, and then the preparation of Au nanoparticle on the CeO_2/Ti substrate electrode was also via the photocatalytic reduction method, the Au (λ_{534nm})/CeO_2/Ti photocathode material was obtained.



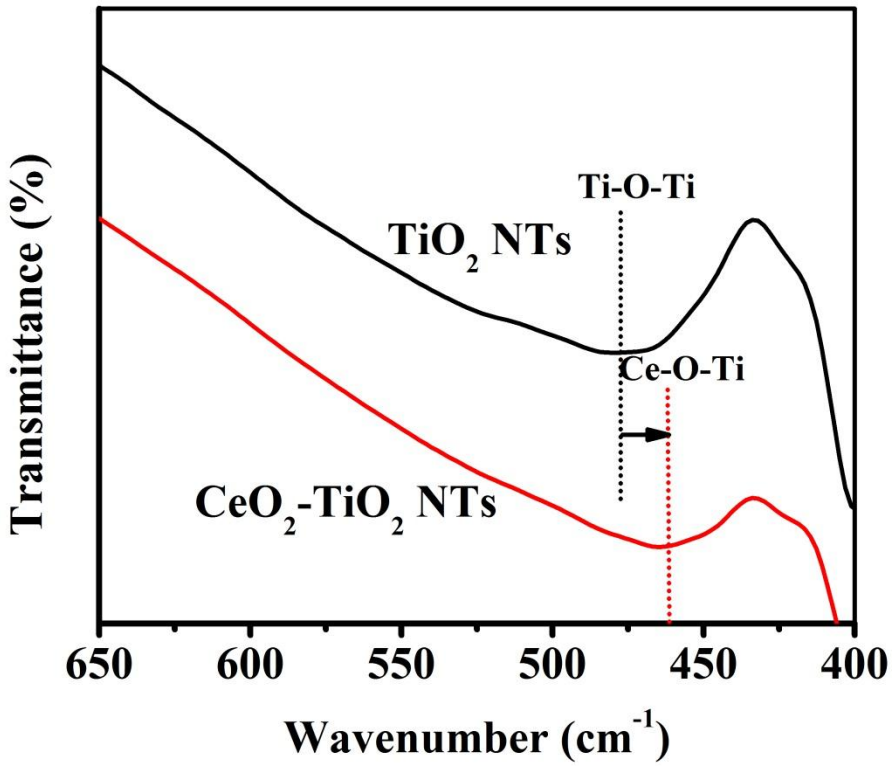
SI-Fig.1 PCE of CeO_2-TiO_2 NTs as a function of the amount of CeO_2 NPs loaded on the TiO_2 NTs substrate electrode. CeO_2-TiO_2 NTs electrodes were used as photocathode and the measurement was conducted in 0.1mol L^{-1} Na_2SO_4 solution under the visible light irradiation.



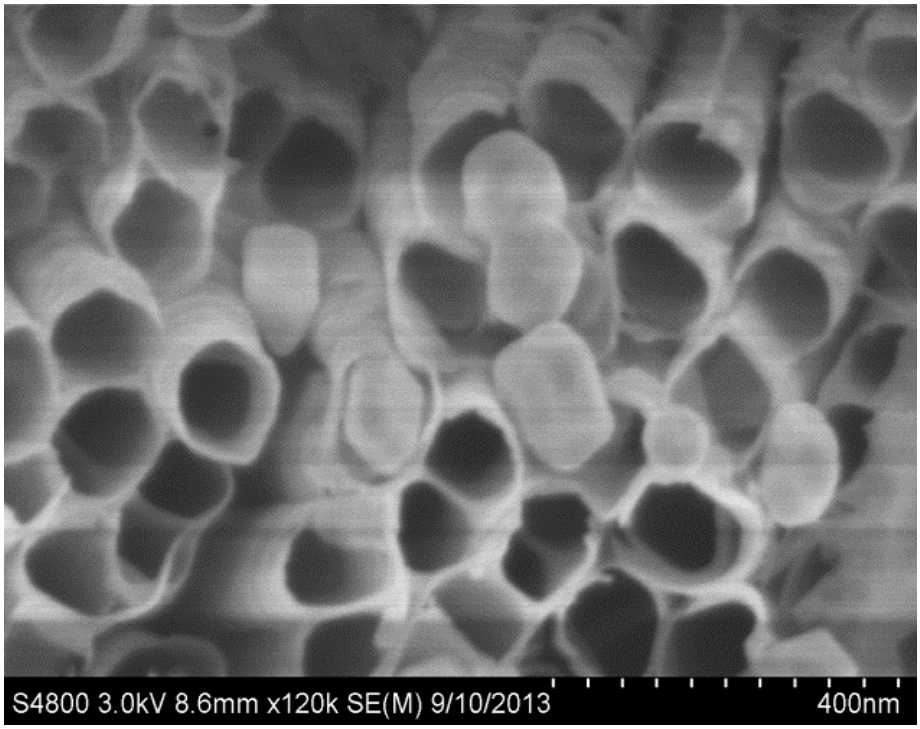
SI-Fig.2 XRD patterns of pure TiO_2 NTs and CeO_2-TiO_2 NTs.



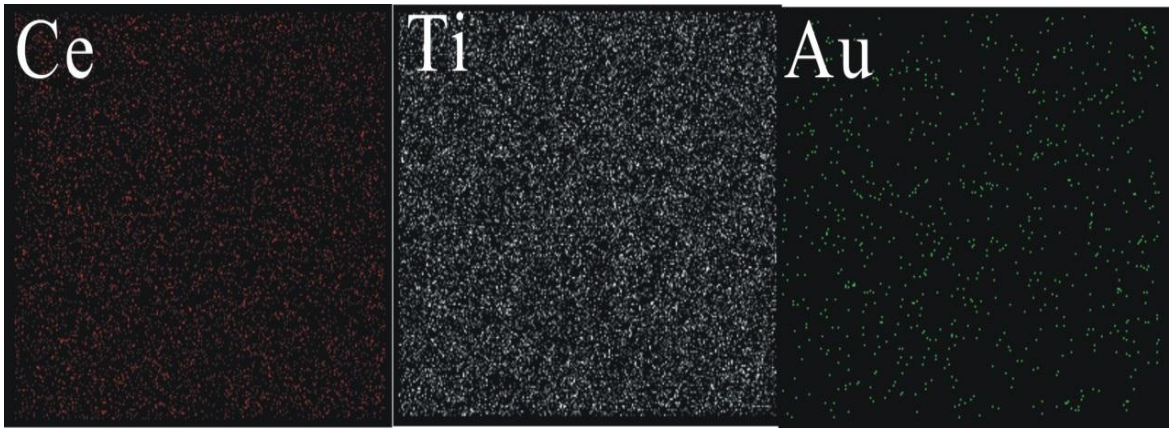
SI-Fig.3 Raman scattering spectra of pure TiO_2 NTs and CeO_2-TiO_2 NTs.



SI-Fig.4 FT-IR spectra of pure TiO_2 NTs and CeO_2-TiO_2 NTs.

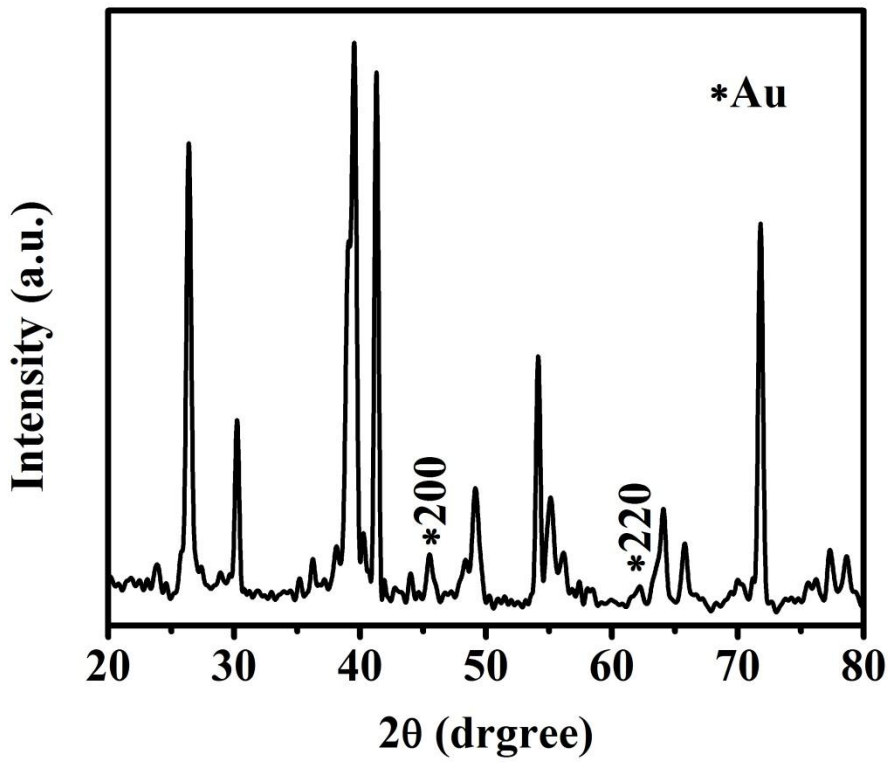


SI-Fig.5 SEM image of Au ($\lambda_{480\ nm}$)/CeO_2-TiO_2 NTs electrode.



SI-Fig.6 The elemential mapping for the debirs of Au ($\lambda_{534\ nm}$)/

CeO_2-TiO_2 NTs



SI-Fig.7 XRD pattern of Au/CeO_2-TiO_2 NTs electrode.