Electronic Supplementary Material (ESI) for *RSC Advances*.

This journal is © The Royal Society of Chemistry 2014

Electronic Supplementary Information

Photocatalytic water oxidation over $PbCrO_4$ with 2.3 eV band gap in IO_3^-/I^- redox mediator under visible light

Yugo Miseki*, Osamu Kitao, and Kazuhiro Sayama*

Energy Technology Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), Central 5, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565. Fax: +81-29-861-4760; Tel: +81-29-861-4760; E-mail: yugo-miseki@aist.go.jp, k.sayama@aist.go.jp.

Experimental

The preparation conditions of $Pt/PbCrO_4$ via Pt photodeposition and Pt impregnation methods.

-Pt photodeposition method-

$PbCrO_4$ (0.2 g) and a H_2PtCl_6 (30.8 μmol) were dispersed in 10 vol% MeOH aqueous solution (100 mL), and then visible light was irradiated to this suspension for 3 hours using 300 W Xe lamp attached with L42 cut off filter. The resulting powder was filtered, washed, and dried at 343 K for 2 h.

-Pt impregnation method-

$PbCrO_4$ (0.2 g) and a H_2PtCl_6 (30.8 μmol) were dispersed in 0.4mL of distill water in magnetic crucible, and then this resulting slurry was evaporated to dry with stirring at 373K. $PtO_x/PbCrO_4$ was obtained by additional thermal treatment in air at 773 K via the thermal decomposition of Pt^{4+} salt.

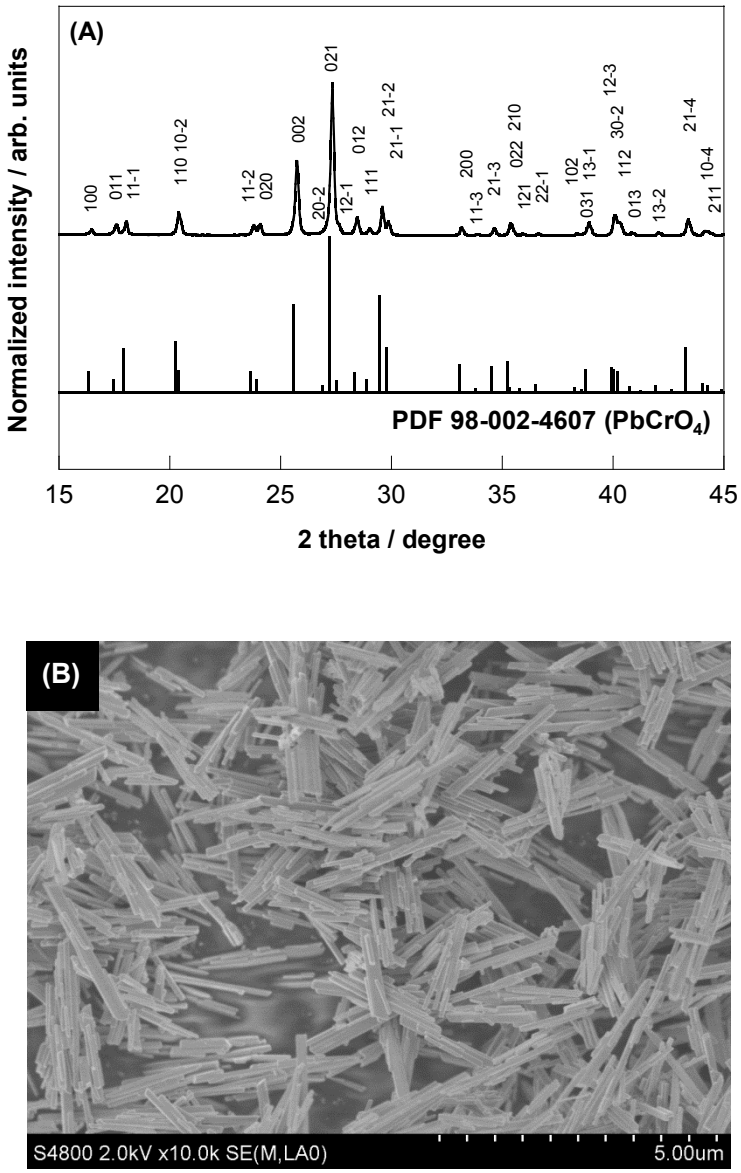


Figure S1. (A) X-ray diffraction pattern and (B) scanning electron microscopy image of $PbCrO_4$ particles prepared by simple precipitation method.

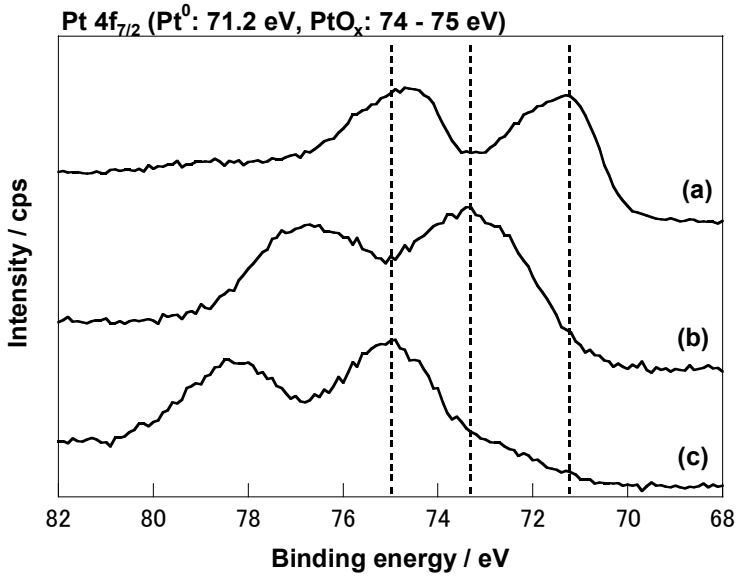


Figure S2. X-ray photoelectron spectra of Pt $4f_{7/2}$ on $Pt/PbCrO_4$ powders prepared by (a) chemical reduction method, (b) impregnation method, and (c) photodeposition method. The horizontal axis of these spectra was corrected by C1s (284.5 eV)

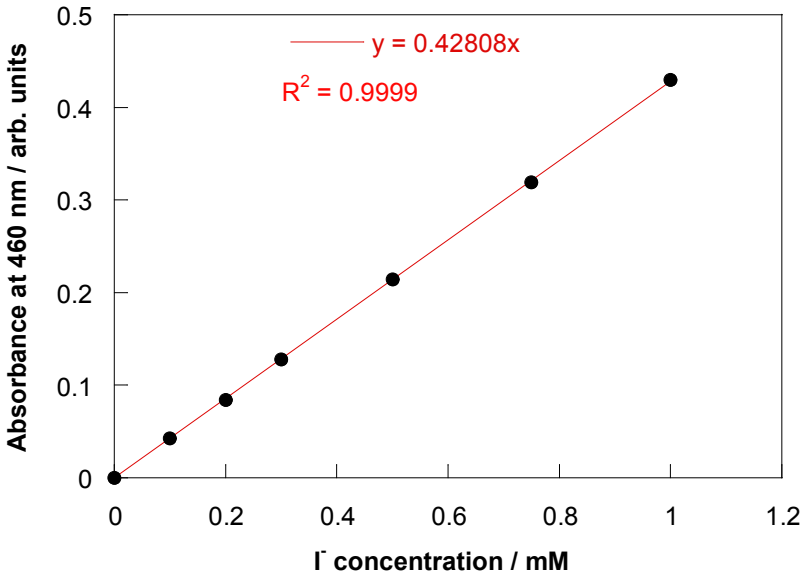
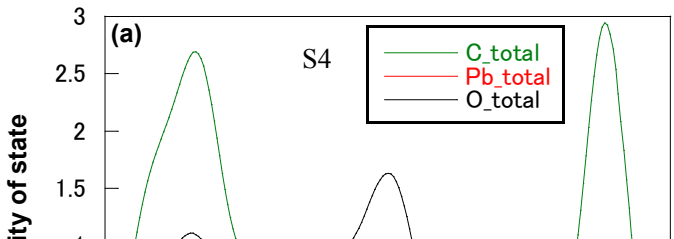


Figure S3. Calibration carve for the quantitative analysis of I^- ion. IO_3^- ion was adding to ensure that total concentration of I^- and IO_3^- was 2mM. I_3^- ion which has yellow absorbance (peak top: 460 nm) was produced after 0.01 mL of conc. H_2SO_4 was adding in 2mL of sample solutions.



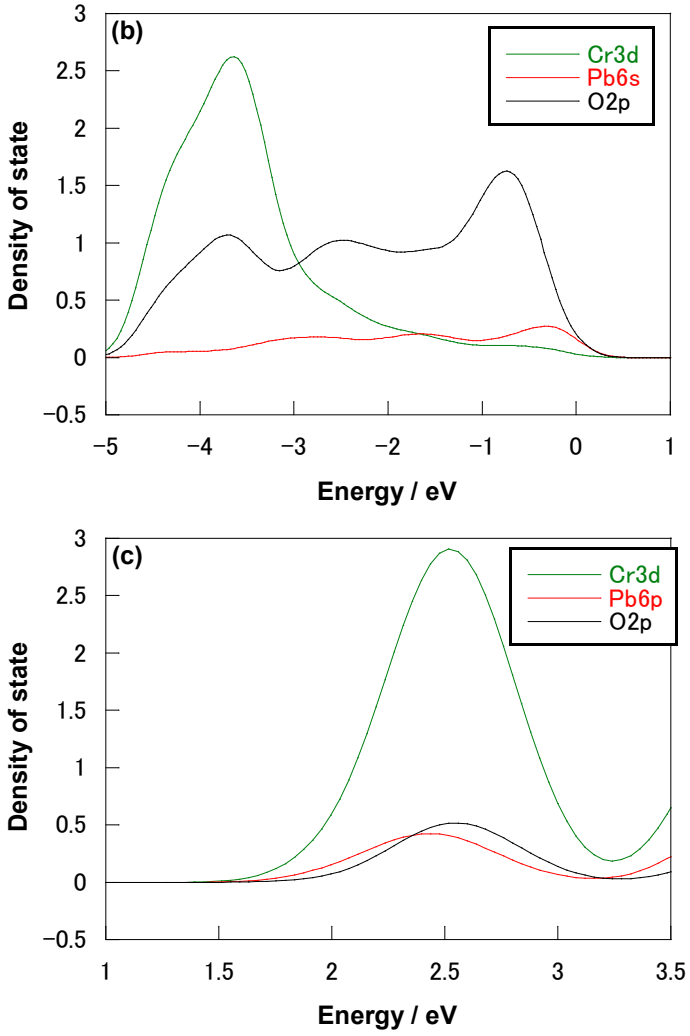


Figure S4. The result of the calculation based on density functional theory (DFT) using the structural parameters from PDF 98-002-4607 ($PbCrO_4$). (a) Partial DOS of each element, (b) Partial DOS of each element and orbital contributed valence band formation, and (c) Partial DOS of each element and orbital contributed conduction band formation.