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Supporting information

Efficient hydrogen evolution from water using CdTe photocathodes under simulated sunlight

Jin Su [a], Tsutomu Minegishi [a,b] and Kazunari Domen [a,] *

[a] *Department of Chemical System Engineering, School of Engineering; The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113–8656, Japan.*

[b] *PRESTO-JST, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113–8656, Japan.*

Tel: 81-3-5841-1148; Fax: 81-3-5841-8838;

Email: domen@chemsys.t.u-tokyo.ac.jp

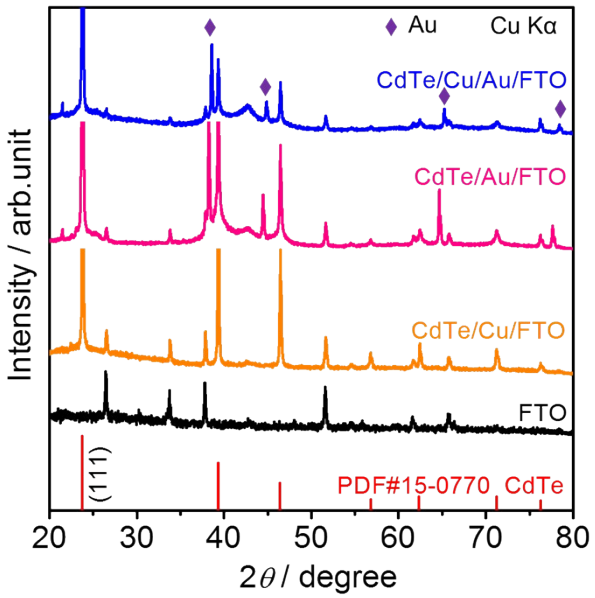

Figure S1. XRD patterns obtained from CdTe/Cu/Au, CdTe/Au/FTO, CdTe/Cu/FTO and FTO substrate. The sharp peak at 21.4° and broad peaks at 40-50° suggest the presence of an oxidized surface layer composed of TeO_x and Cd_xTeO_y and excess elemental Te.

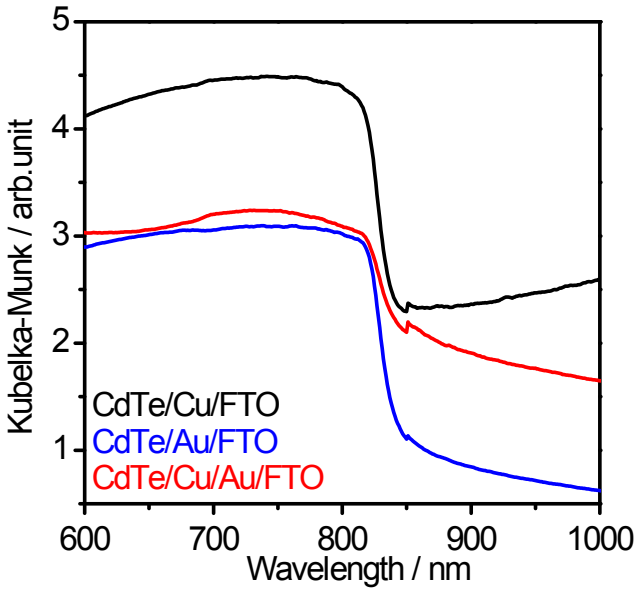

Figure S2. UV-vis diffuse reflectance spectra obtained from CdTe/Cu/Au, CdTe/Au/FTO and CdTe/Cu/FTO. Each sample exhibits a typical absorption edge wavelength of 830 nm, indicating the substrate cannot affect the bandgap of the CdTe. The steps at 840 nm are the result of grating switching.

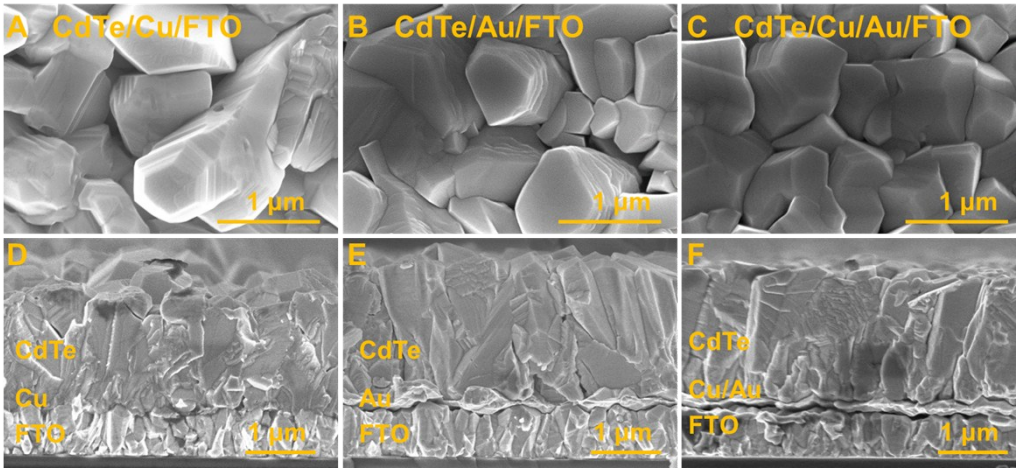

Figure S3. (A-C) Plan-view and (D-F) cross-sectional SEM images of CdTe/Cu/Au, CdTe/Au/FTO and CdTe/Cu/FTO.

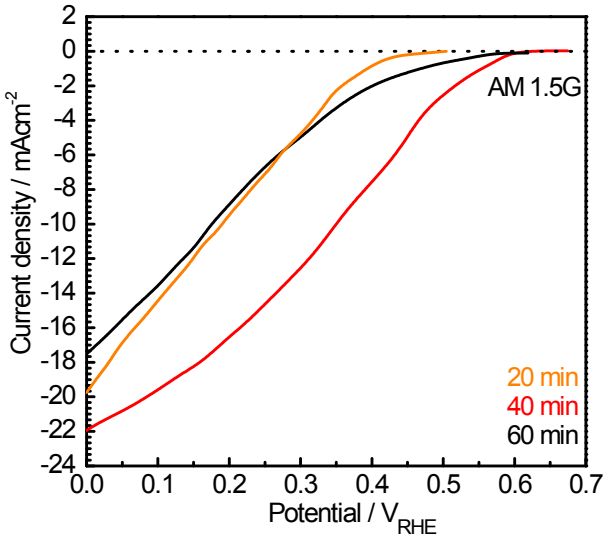

Figure S4. Current-potential curves for Pt/CdS/CdTe($CdCl_2$)/Cu/Au/FTO photocathodes with different $CdCl_2$ treatment conditions, applying ramp up times of 20, 40 and 60 min. Simulated sunlight and a 1 M aqueous KPi solution with pH adjusted to 8 were used as the light source and electrolyte, respectively. The applied potential scan rate was +10 mV s^{-1}. It was concluded that the applying ramp up times of 40 min was the optimum condition of $CdCl_2$ treatment for CdTe photocathode preparation.

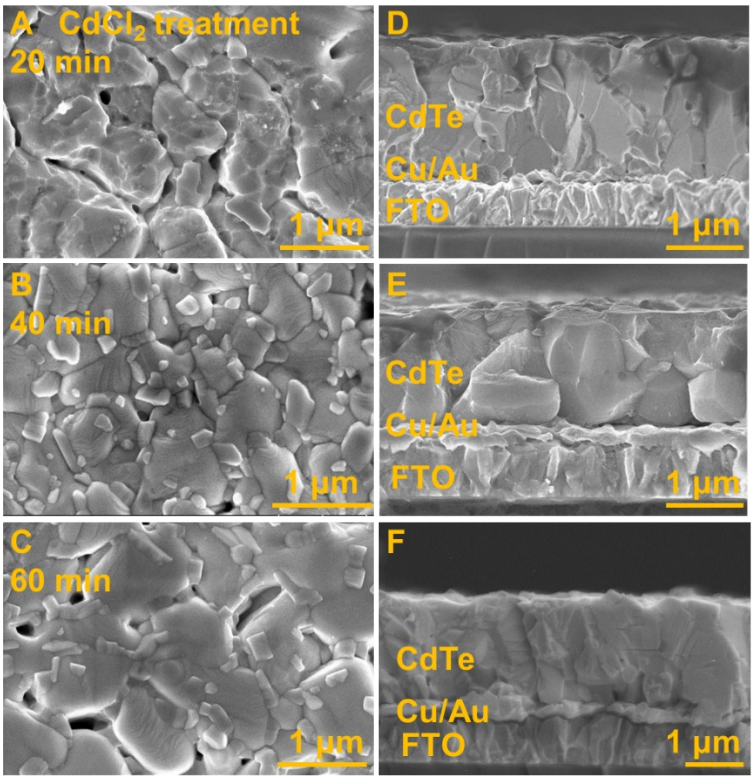

Figure S5. (A-C) Plan-view and (D-F) cross-sectional SEM images of CdTe($CdCl_2$)/Cu/Au with different $CdCl_2$ treatment conditions; ramp up time of 20, 40 and 60 min. The 40 min treated CdTe film became much planar surface, large circular grains and less grain boundaries. This CdTe specimen prepared by the optimum condition of $CdCl_2$ treatment with beneficial factor for improvement of PEC performances.

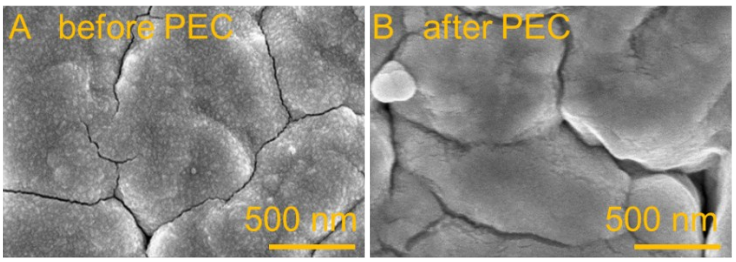

Figure S6. Plan-view SEM images of Pt/CdS/$CdCl_2$/CdTe/Cu/Au (A) before and (B) after durability test shown in Figure 8. Surface morphology was changed after the PEC measurement.

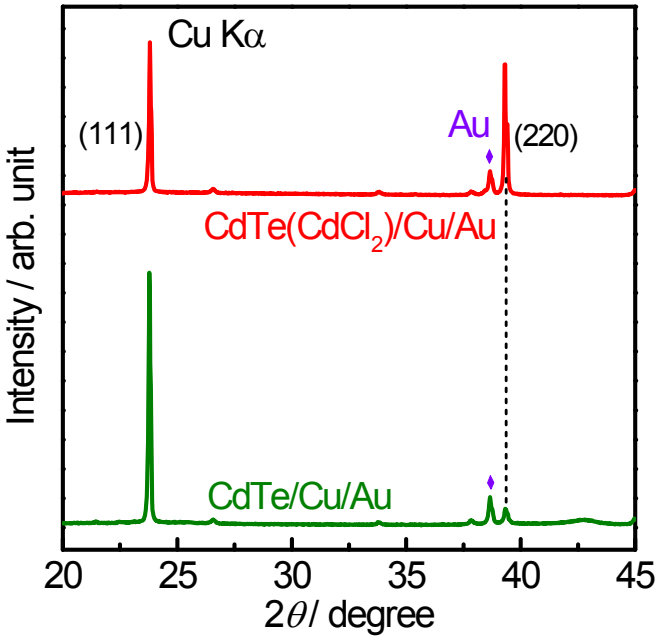

Figure S7. Enlarged XRD patterns obtained from $CdTe(CdCl_2)/Cu/Au$ and CdTe/Cu/Au for explanation of transitioned crystal orientation from (111) to mixture of mainly (111) and (220) upon $CdCl_2$ treatment.