Electronic Supplementary Material (ESI) for Dalton Transactions.

Photoelectrochemical properties of single-grain hematite films grown by electric-field-assisted liquid phase deposition

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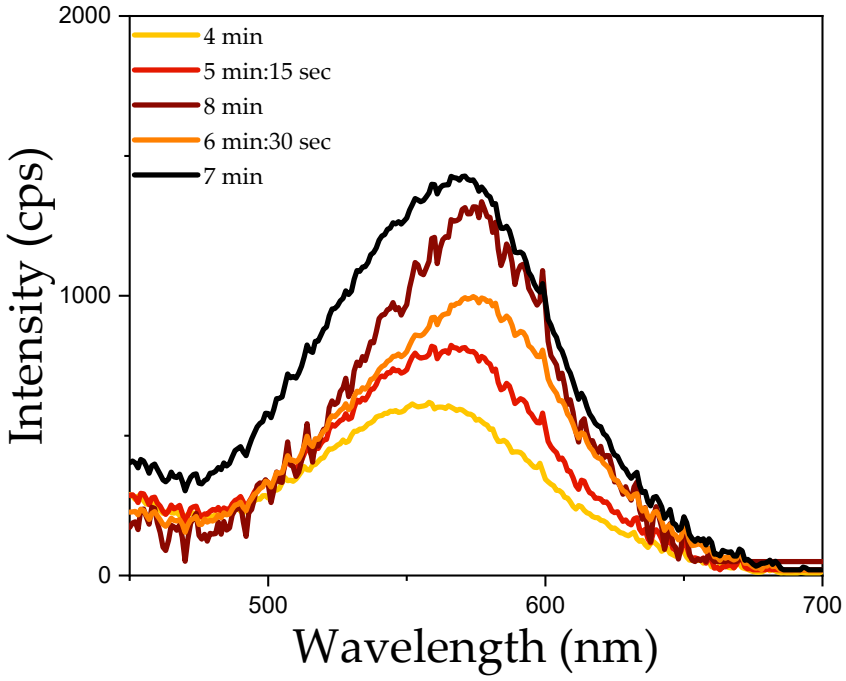

Figure S1. The PL spectra of the films with different thicknesses.

To further analyze the performance of the photo electrode, the method reported by Dotan and colleagues [1] was used to estimate the charge separation and catalytic efficiencies. The total photocurrent is described according to the following equation:

$$J_{H_2O} = J_{abs} \times \eta_{separation} \times \eta_{catalytic} \quad (1)$$

where J_{abs} is the photon absorption rate, which is presented as a current. It is determined by multiplying the AM1.5G spectrum by the absorption spectrum followed by integration over wavelength. $\eta_{separation}$ is the charge separation efficiency. $\eta_{catalytic}$ is also the catalytic efficiency for water oxidation. By adding H_2O_2 to the electrolyte, it acts as a very effective hole scavenger and the corresponding photocurrent is denoted as $J_{H_2O_2}$ as following:

$$J_{H_2O_2} = J_{abs} \times \eta_{separation} \quad (2)$$

Based on the above two equations, $\eta_{separation}$ and $\eta_{catalytic}$ are obtained according to the following equations:

$$\eta_{catalytic} = \frac{J_{H_2O}}{J_{H_2O_2}} \quad (3)$$

$$\eta_{separation} = \frac{J_{H_2O_2}}{J_{abs}} \quad (4)$$

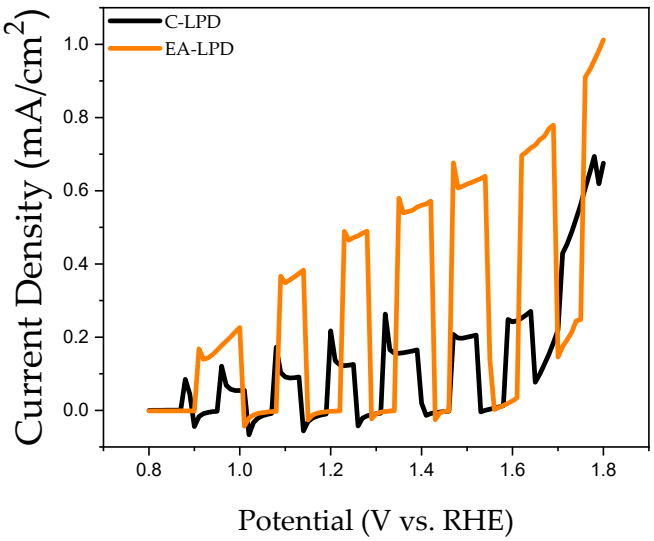

Figure S2. J-V curves under chopped light condition for C-LPD and EA-LPD films.

1. Dotan, H.; Sivula, K.; Grätzel, M.; Rothschild, A.; Warren, S. C. *Energy & Environmental Science* **2011,** 4, (3), 958-964.