Supporting Information

Simultaneous Doping and Growth of Sn-doped Hematite Nanocrystalline Films with Improved Photoelectrochemical Performance

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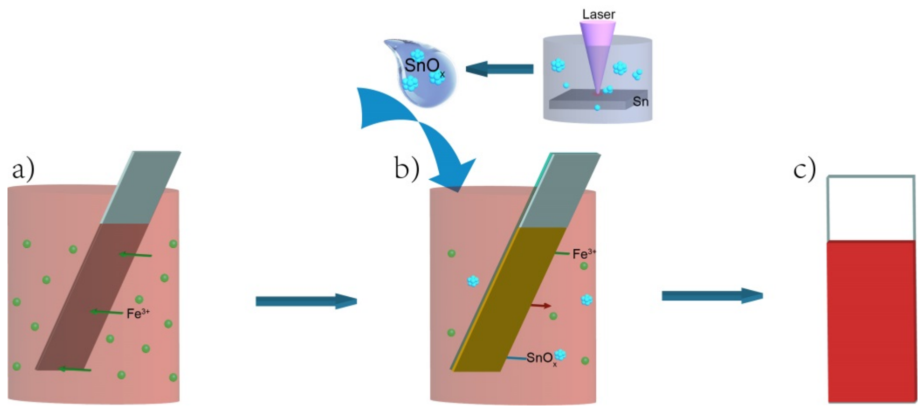

Figure S1. Step-diagram of $Sn:Fe_2O_3$ film growth. a) A Teflon-lined stainless steel autoclave was filled with 25 mL aqueous solution containing 0.405 g of $FeCl_3$•$6H_2O$ and 0.650 g of $NaNO_3$. A piece of FTO glass slide, washed with acetone, ethanol, and then deionized water, was put into the autoclave and A uniform yellow layer of iron oxyhydroxides (β-FeOOH) was formed after heated at 120 °C for 5 h. b) A gray SnO_x colloidal solution was obtained after laser ablation 20 min. The prepared SnO_x colloidal solution was used as the Sn doping source that was homogeneously mixed with 5 mL of $FeCl_3$ (10 mM) solution. Around 10 mL of deionized H_2O was added to the solution so that its total volume was 30 mL. A piece of the as-prepared β-FeOOH nanorod-array film was placed in this mixture and the Sn-doped hematite films was formed after treated at 220 °C for 18 h. c) The Sn-doped hematite film.

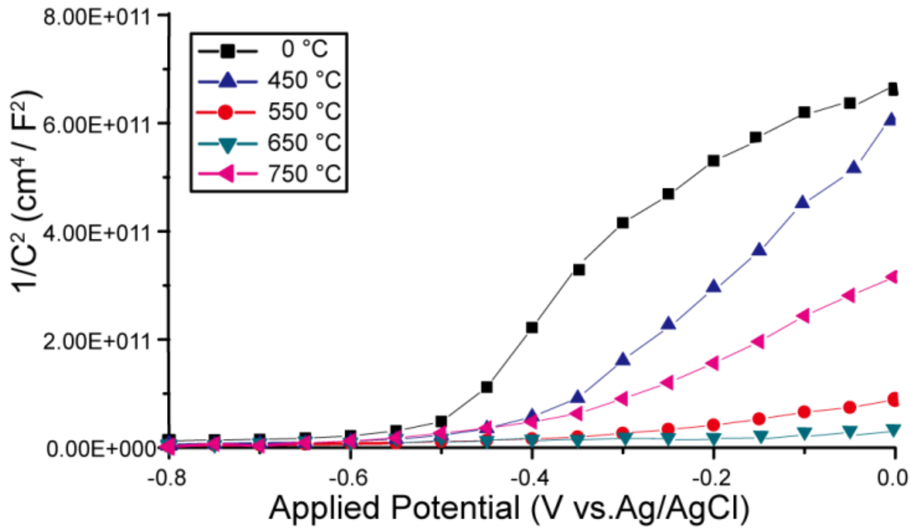

Figure S2. Mott-Schottky plots under dark condition at a frequency of 1 KHz for different annealing temperature of the samples.

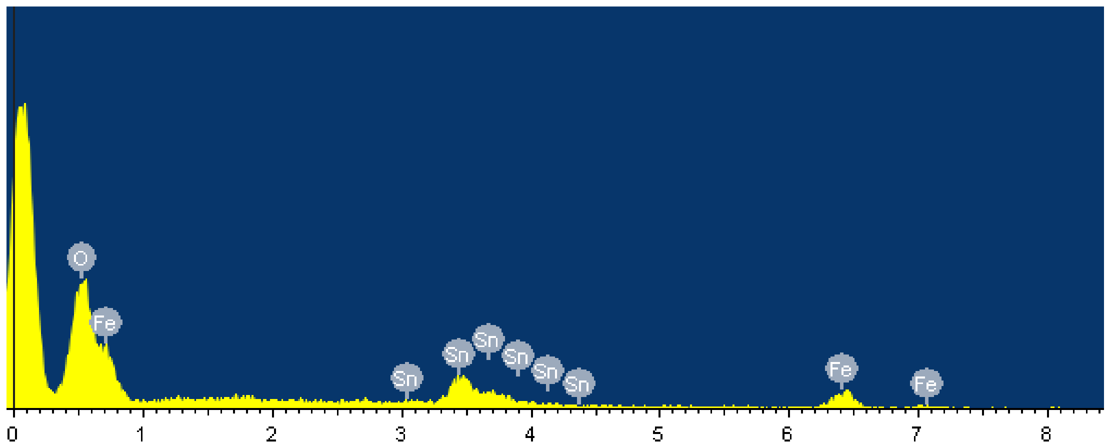

Figure S3. EDS spectrum of Sn:Fe_2O_3 film.

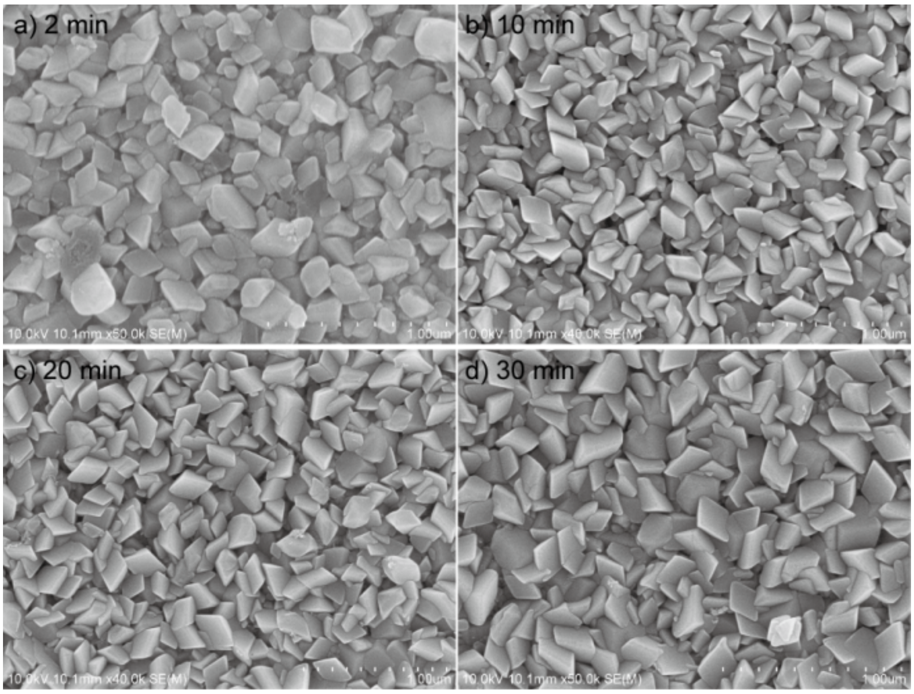

Figure S4 SEM images of different doping levels, and this parameter depended on laser ablation duration.

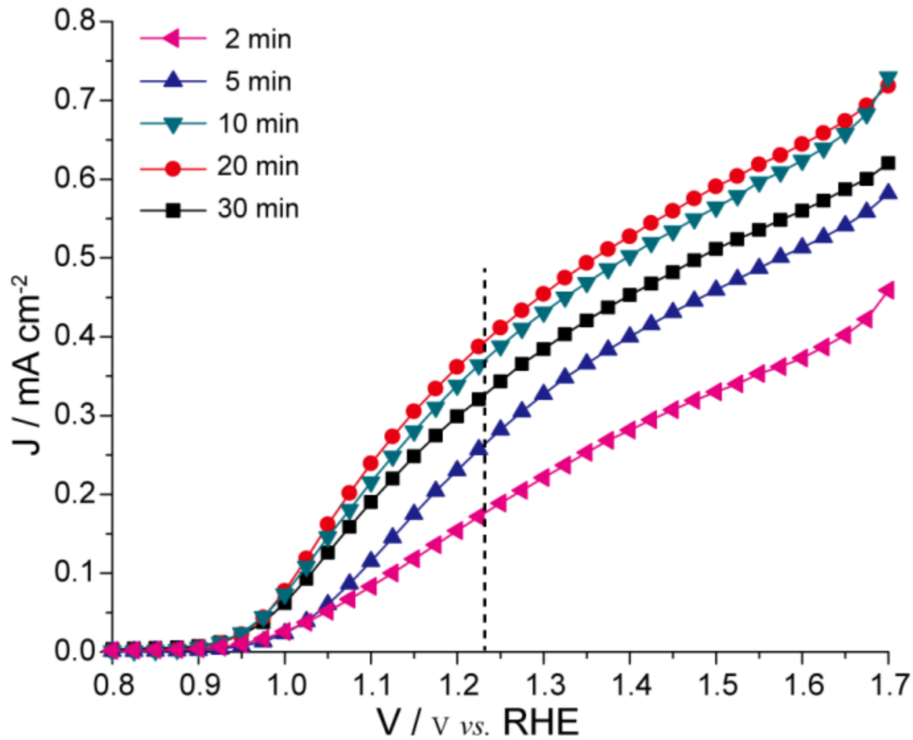

Figure S5. *J-V* curves of different Sn doping concentrations (after thermal treatment at 600°C). Sn doping levels were tuned by adjusting the concentrations of the Sn colloidal solution, and this parameter depended on the duration time of laser ablation.

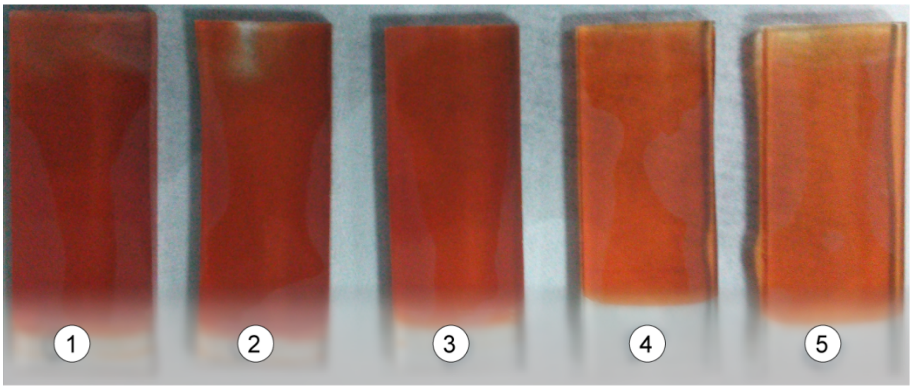

Figure S6. Photo-images of hematite nanocrystalline films with different Sn-doped concentration. Different ablation duration for Sn colloidal solutions: (1) 2 min, (2) 5 min, (3) 10 min, (4) 20min, (5) 30min.