

Supporting Information:

Organohalide Lead Perovskite Based Photodetectors with Much Enhanced Performance

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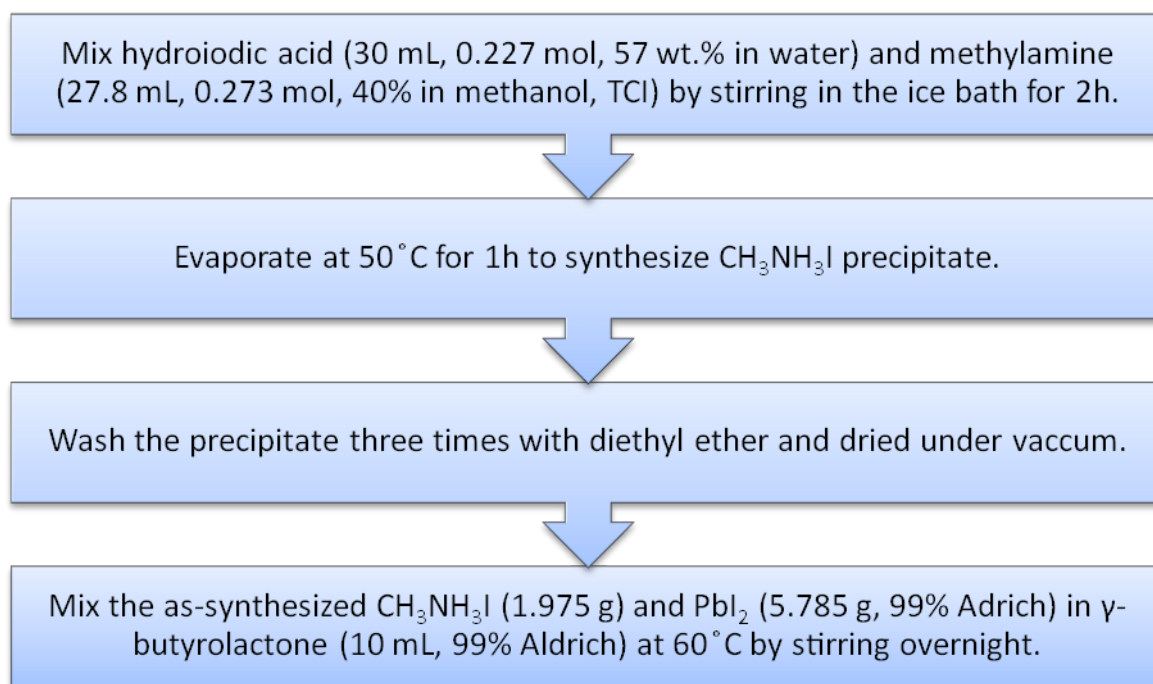
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1. CH₃NH₃PbI₃ Synthesis

Organohalide lead perovskite (CH₃NH₃PbI₃) was prepared according the reported procedure¹. Hydroiodic acid (30 mL, 0.227 mol, 57 wt% in water, Aldrich) and methylamine (27.8 mL, 0.273 mol, 40% in methanol, TCI) were mixed and stirred in the ice bath for 2 h. After stirring at 0 °C for 2 h, the resulting solution was evaporated at 50 °C for 1 h and generated chemicals (CH₃NH₃I). The precipitate was washed three times with diethyl ether, dried under vacuum and used without further purification. To prepare CH₃NH₃PbI₃, readily synthesized CH₃NH₃I (1.975 g) and PbI₂ (5.785 g, 99% Aldrich) were mixed in γ -butyrolactone (10 mL, 99% Aldrich) at 60 °C for overnight with stirring. To make the process clearer, the fabrication scheme for CH₃NH₃PbI₃ was described in Scheme S1. And the as-synthesized CH₃NH₃PbI₃ solution is yellow shown as Figure S1a.



Scheme S1. Fabrication scheme of $\text{CH}_3\text{NH}_3\text{PbI}_3$.

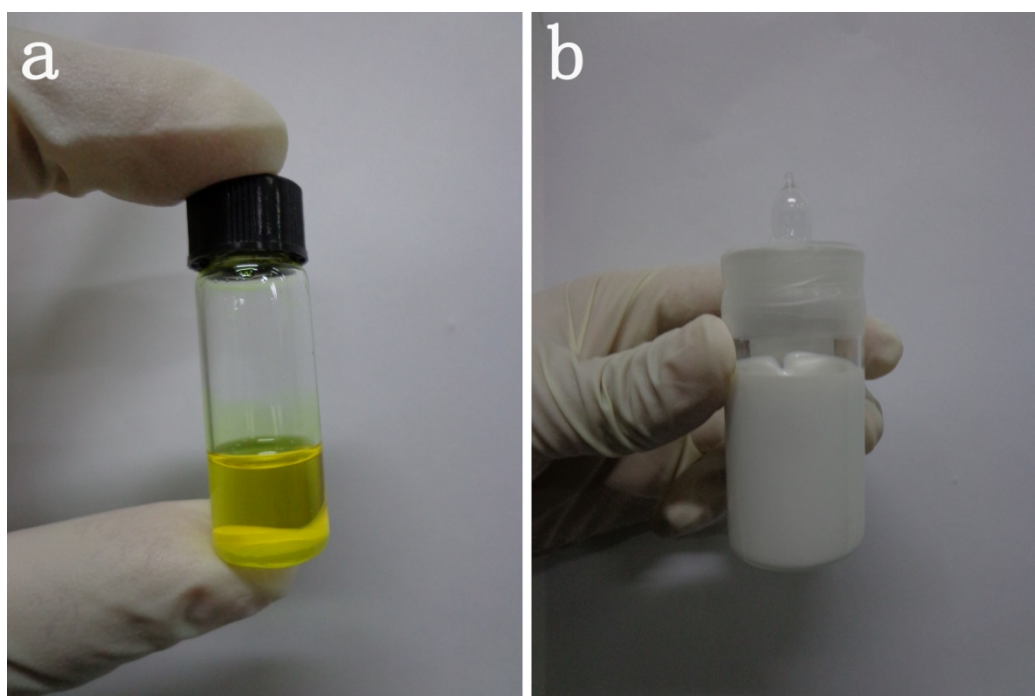
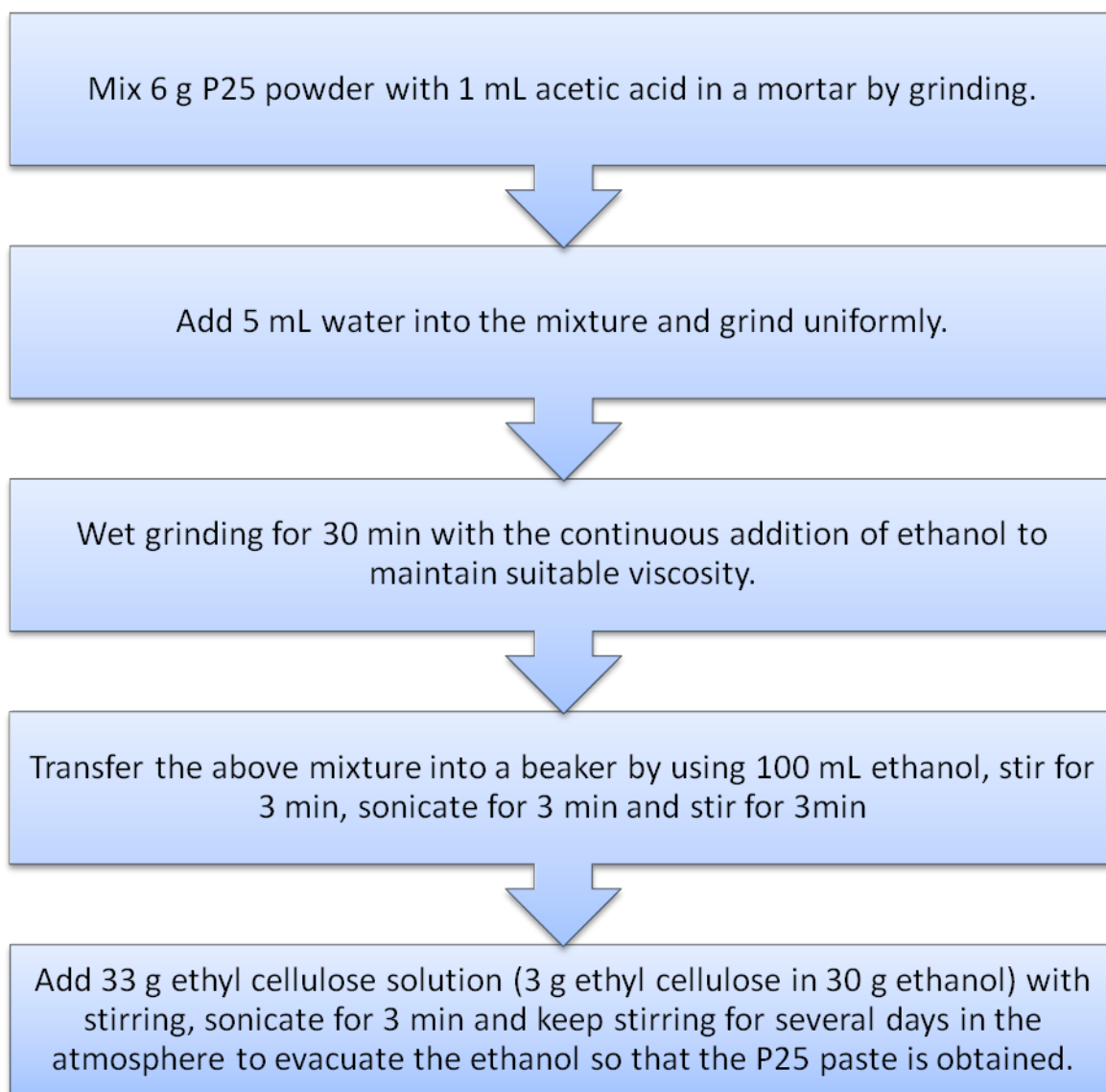


Figure S1. (a) Photograph of the as-prepared $\text{CH}_3\text{NH}_3\text{PbI}_3$ solution. (b) Photograph of TiO_2 paste.

2. Preparation of TiO₂ paste

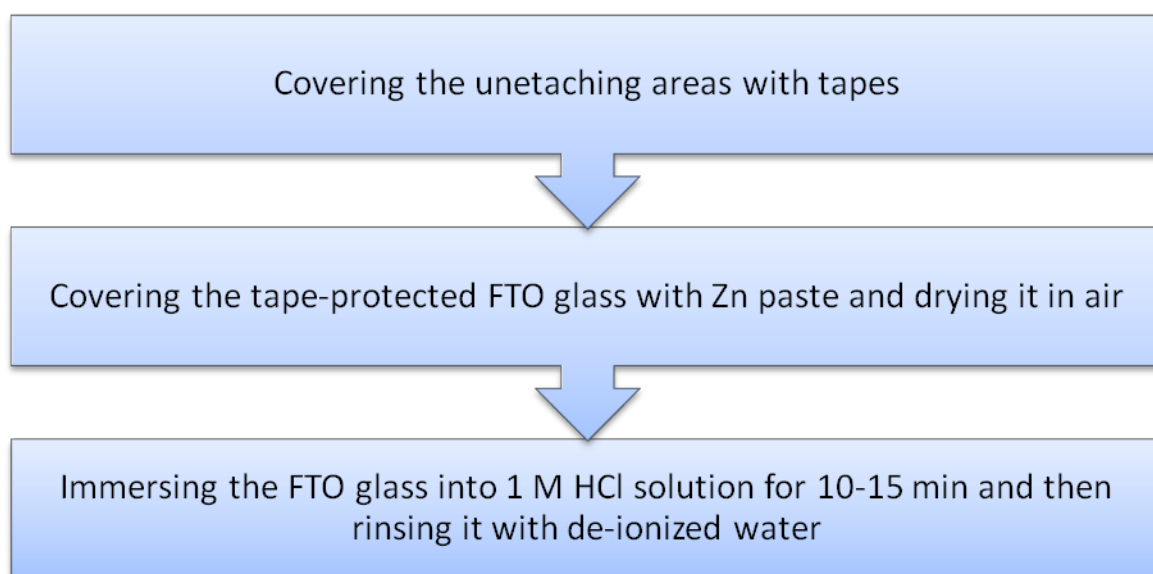
The TiO₂ paste was prepared according a simplified procedure similar with Gratzel's report². Firstly, 6 g P25 powder was uniformly mixed with 1 mL acetic acid in a mortar by grinding. Then 5 mL water was added into the mortar and mixed with P25 uniformly. After that, wet grinding for 30 minutes with the addition of ethanol each time when the paste was nearly dry. Thirdly, the paste was transferred into a beaker with using 100 mL ethanol, stirred with a magnet tip for 3 min, sonicated with an ultrasonic cleaning machine and stirred for 3min. At last, 33 g ethyl cellulose solution (3 g ethyl cellulose in 30 g ethanol) was added with stirring, sonicated for 3 min and then kept stirring for several days in the atmospheric environment to evaporate the ethanol until the viscosity was appropriate and P25 paste was obtained. To make the process clearer, the fabrication scheme of TiO₂ paste was shown in Scheme S2. And the as-prepared TiO₂ paste is shown in Figure S1b.



Scheme S2. Fabrication scheme of P25 paste.

3. Fabrication of FTO electrodes for photodetectors

The FTO electrodes were fabricated by etching the FTO glass with the mixture of Zinc powder and 1 M hydrochloride solution. Firstly, the unetching parts of the FTO glass was protected by covering them with tapes. Secondly, the FTO glass was coated by Zn paste which was fabricated by mixing Zn powder and de-ionized water, and dried in air. At last, they were immersed into 1 M hydrochloride solution for 10-15 min to detaching FTO from the FTO glass, and then rinsed with de-ionized water. In this way, the FTO electrodes on glass were successfully fabricated. Figure S2 shows an array of FTO electrodes on the glass.



Scheme S3. Fabrication of FTO electrodes on glasses for photodetectors.

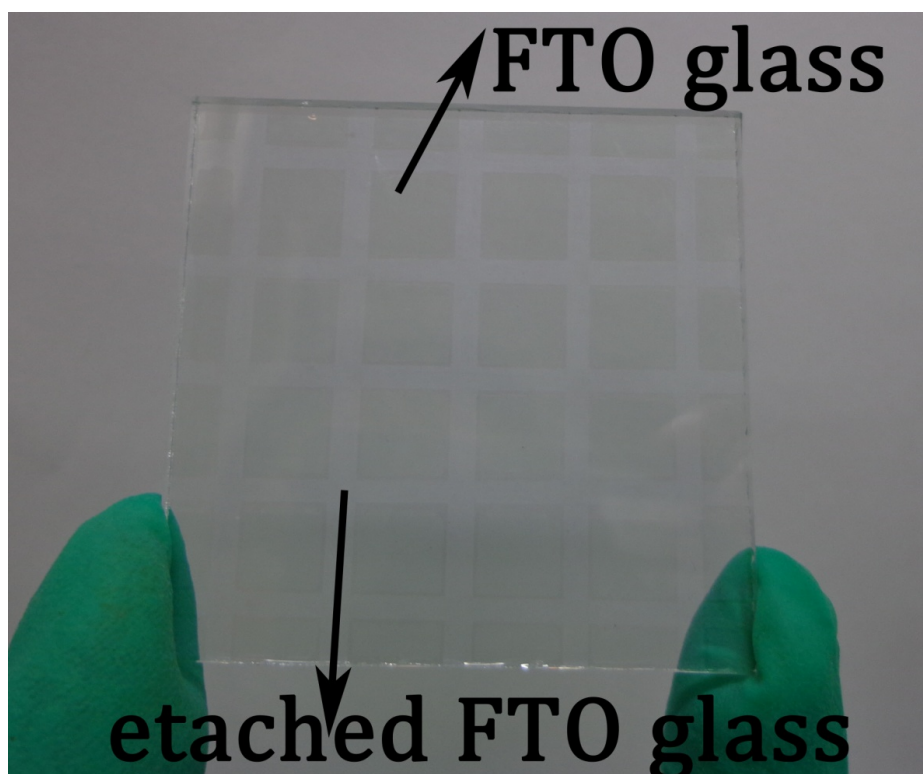


Figure S2. Photographs of FTO electrode arrays on a glass.

References

1. H. S. Kim, C. R. Lee, J. H. Im, K. B. Lee, T. Moehl, A. Marchioro, S. J. Moon, R. Humphry-Baker, J. H. Yum, J. E. Moser, M. Gratzel and N. G. Park, *Scientific Reports*, 2012, **2**, 591.
2. S. Ito, P. Chen, P. Comte, M. K. Nazeeruddin, P. Liska, P. Pechy and M. Gratzel, *Progress in Photovoltaics*, 2007, **15**, 603.