

**Supplementary Information:**

**Preparation of pure active water for auto-catalytic reactions performed in it**

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## **Supplementary experimental**

### **Measurement of zeta potential of different kinds of water**

Zeta potentials of water samples (600  $\mu$ L) were analyzed using a Malvern Zetasizer Nano ZS zeta potential analyzer ( $n=3$  for each measurement). To avoid the influence of bacteria on the zeta potential during storage, samples were filtered through a 0.22- $\mu$ m-pore membrane to remove bacteria. Parafilm-sealed samples were placed in the dark before measurement. Errors were obtained from the relative standard deviation (RSD).

### **Measurement of NMR relaxation time of different kinds of water**

The NMR  $T_1$  values of DIW, PAW, PV1 and PV2 (different condensed water collected from PAW vapors) were measured at atmospheric pressure with a Bruker Fourier 300 spectrometer, operating at a 300 MHz  $^1\text{H}$  resonance frequency. For the measurement, a repetition time of 6 s and acquisition of nine signal averages were employed for each delay time. Data were analyzed with the help of the Bruker  $T_1$  analytical routine in a software package.

### **Density of different kinds of water/alcohol solutions in ambient laboratory air**

First, different ratios of water (DIW or PV1 or PV2)/alcohol solutions in capped glass sample bottles were mixed well with a stir bar on a magnet stirrer. Then, the densities of three sets of water/alcohol solutions were individually measured three times based on three new prepared samples using a density meter (DA-130 N, Kyoto Electronics, Japan) at room temperature. The exact value was recorded to the third decimal place.

### **Evaporation rate of different kinds of water/alcohol solution at room temperature into ambient laboratory air**

First, different ratios of water (DIW or PV1 or PV2)/alcohol solutions in capped glass sample bottles were well mixed with a stir bar on a magnet stirrer. Then three sets of water/alcohol solutions (15 mL) were individually added to 20-mL sample bottles (three bottles for each set), which were placed on a platform of an orbital shaker, operating at 150 rpm. The weight of each open glass bottle, containing water in a glass bottle, was measured after experiment for 30 min to determine the evaporated mass (g) of water/alcohol solution. The evaporated mass was determined by the whole

mass at the beginning of the experiment minus the whole mass (including the solution and glass bottle) after 30 min. Replicate measurements based on three similar samples were performed.

### **Oxidation-reduction cycles (ORCs) in different kinds of water solutions**

All of the electrochemical experiments were performed in a three-compartment cell at room temperature, ca. 25 °C, and were controlled by a potentiostat (model PGSTAT30, Eco Chemie). A gold sheet with a bare surface area of ca. 0.283 cm<sup>2</sup>, a 1 × 4 cm<sup>2</sup> platinum sheet, and a KCl-saturated silver-silver chloride (Ag/AgCl) electrode were employed as the working, counter and reference electrodes, respectively. Before the ORC treatment, the gold electrode was polished successively with 1 and 0.05 μm of alumina slurry to a mirror finish. Then the electrode was cycled in a deoxygenated 0.1 N KCl aqueous solution (based on DIW or PAW or PV1 or PV2) from -0.28 to +1.22 V vs Ag/AgCl at 500 mV s<sup>-1</sup> for 25 scans. The durations at the cathodic and anodic vertices are 10 and 5 s, respectively. Finally, the potential was hold at the cathodic vertex before the roughened Au electrode was taken from the solution and rinsed thoroughly with DIW. The prepared substrate was dried in a dark vacuum-dryer for 1 h at room temperature for subsequent use. These ORC procedures were generally employed in our laboratory<sup>1</sup> and others.<sup>2</sup>

### **Reversible oxidation-reduction reactions in different kinds of water solutions**

A planar Pt electrode with a bare surface area of ca. 0.071 cm<sup>2</sup>, a 1 × 4-cm platinum sheet, and a KCl-saturated silver-silver chloride (Ag/AgCl) electrode were respectively employed as the working, counter, and reference electrodes. Before the experiment, the Pt electrode was successively polished with 1 and 0.05 μm alumina slurries to a mirror finish. The polished electrode was further rinsed with DIW in an ultrasonic cleaner. The cleaned electrode was dried in a vacuum-dryer for 2 h at 50 °C for subsequent use. The electrochemical reversible oxidation-reduction reaction of K<sub>3</sub>Fe(CN)<sub>6</sub> was measured in DIW (or PAW, PV1, or PV2) with 0.05 (or 0.1) M K<sub>3</sub>Fe(CN)<sub>6</sub> at a scan rate of 0.05 (or 0.2) V s<sup>-1</sup>.

### **Hydrogen evolution reactions (HERs) in different kinds of water solutions**

HERs performed in different pH values were evaluated by linear sweep voltammetry (LSV) in a three-electrode system consisting of a Pt (or stainless steel) electrode (ca. 0.283 cm<sup>2</sup>), a 1 × 4 cm<sup>2</sup> Pt sheet, and a KCl-saturated Ag/AgCl electrode as the

working, counter, and reference electrodes, respectively. Typically, the corresponding electrochemical measurement was carried out in a deoxygenated 35-mL DIW (or PAW or PV1 or PV2) solution with 0.1 N KCl (or KOH or H<sub>2</sub>SO<sub>4</sub>) at a scan rate of 0.05 V s<sup>-1</sup>. These electrochemical experiments were also controlled by a potentiostat (model PGSTAT30, Eco Chemie).

### Notes and references

- 1 Y. C. Liu, T. C. Hsu and J. F. Tsai, *J. Phys. Chem. C*, 2007, **111**, 10570–10574.
- 2 C. C. Wang, *J. Phys. Chem. C*, 2008, **112**, 5573–5578.

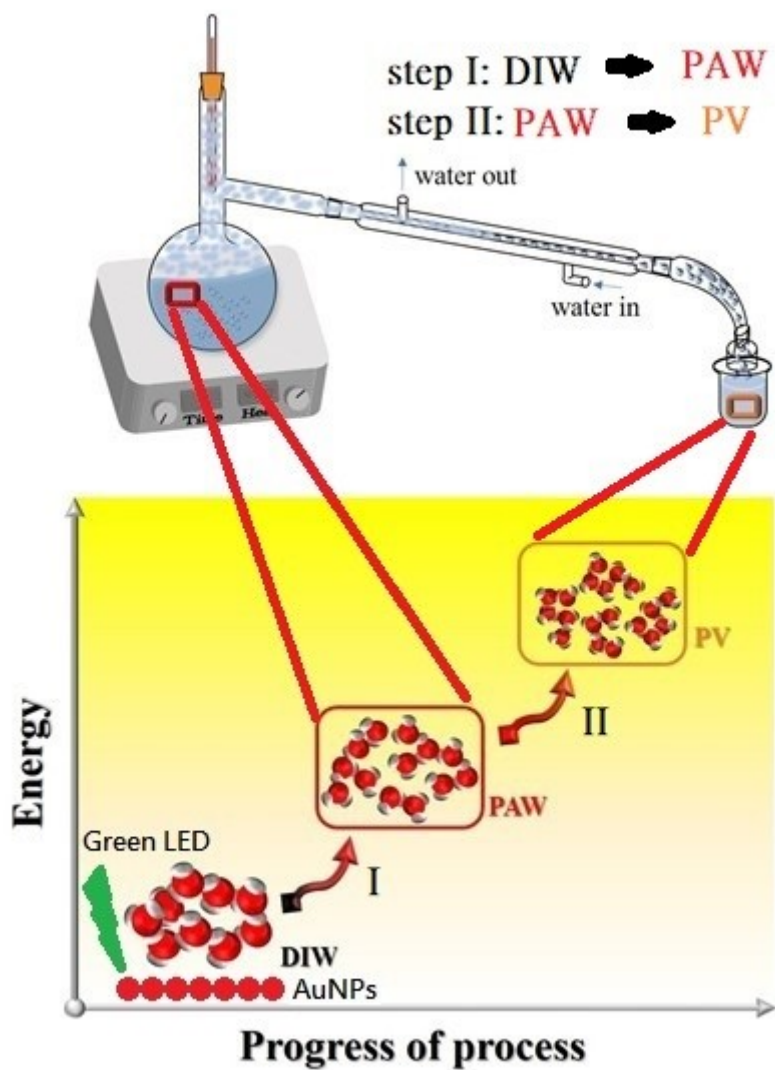


Fig. S1. Schematic diagram of the experimental setup for collecting condensed plasmon-activated water (PAW) vapor (PV1 and PV2) from PAW under heating in ambient laboratory air.

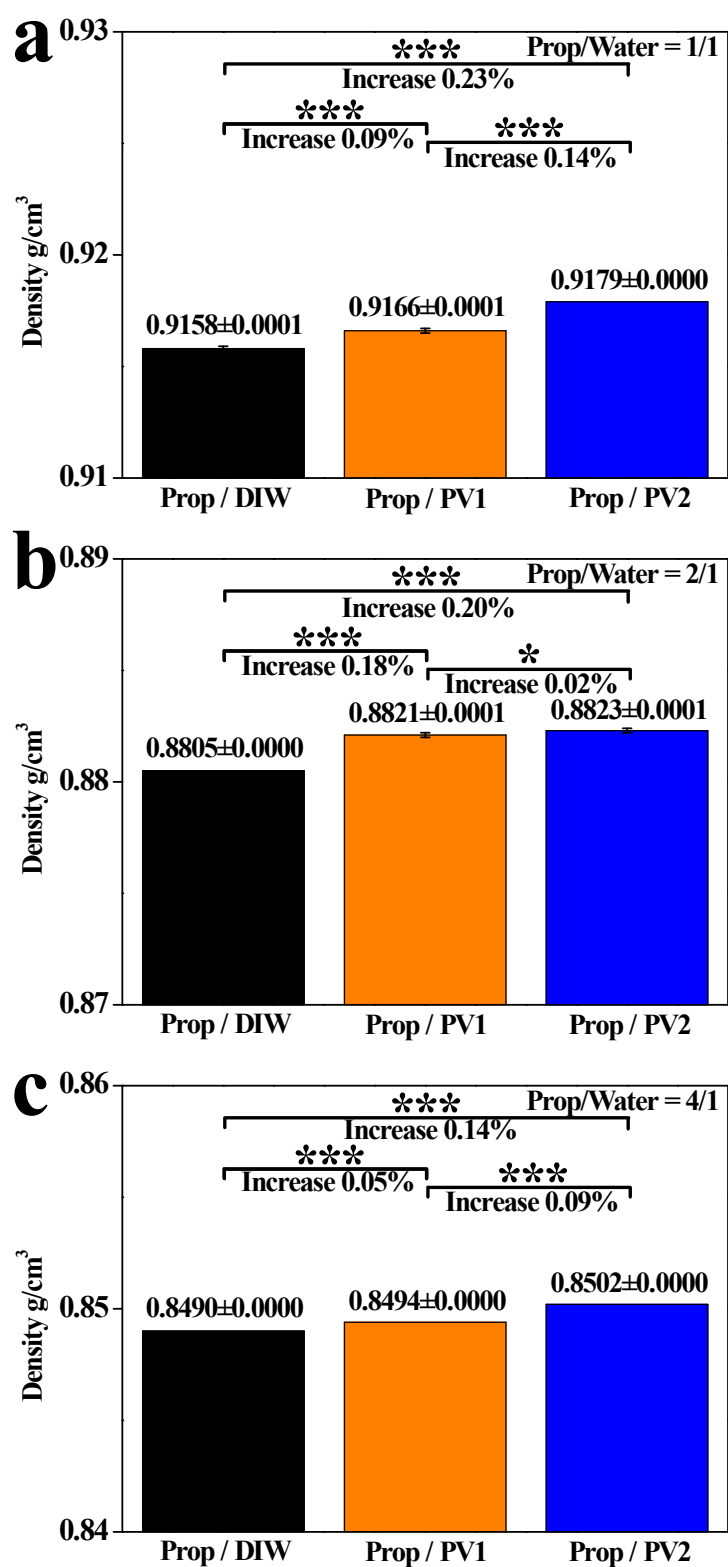


Fig. S2. Densities of different ratios of propanol (Prop)/deionized water (DIW) (or PV1 or PV2) solutions. (a) Ratio of 1:1. (b) Ratio of 2:1. (c) Ratio of 4:1. \*  $p < 0.05$  and \*\*\*  $p < 0.001$ .

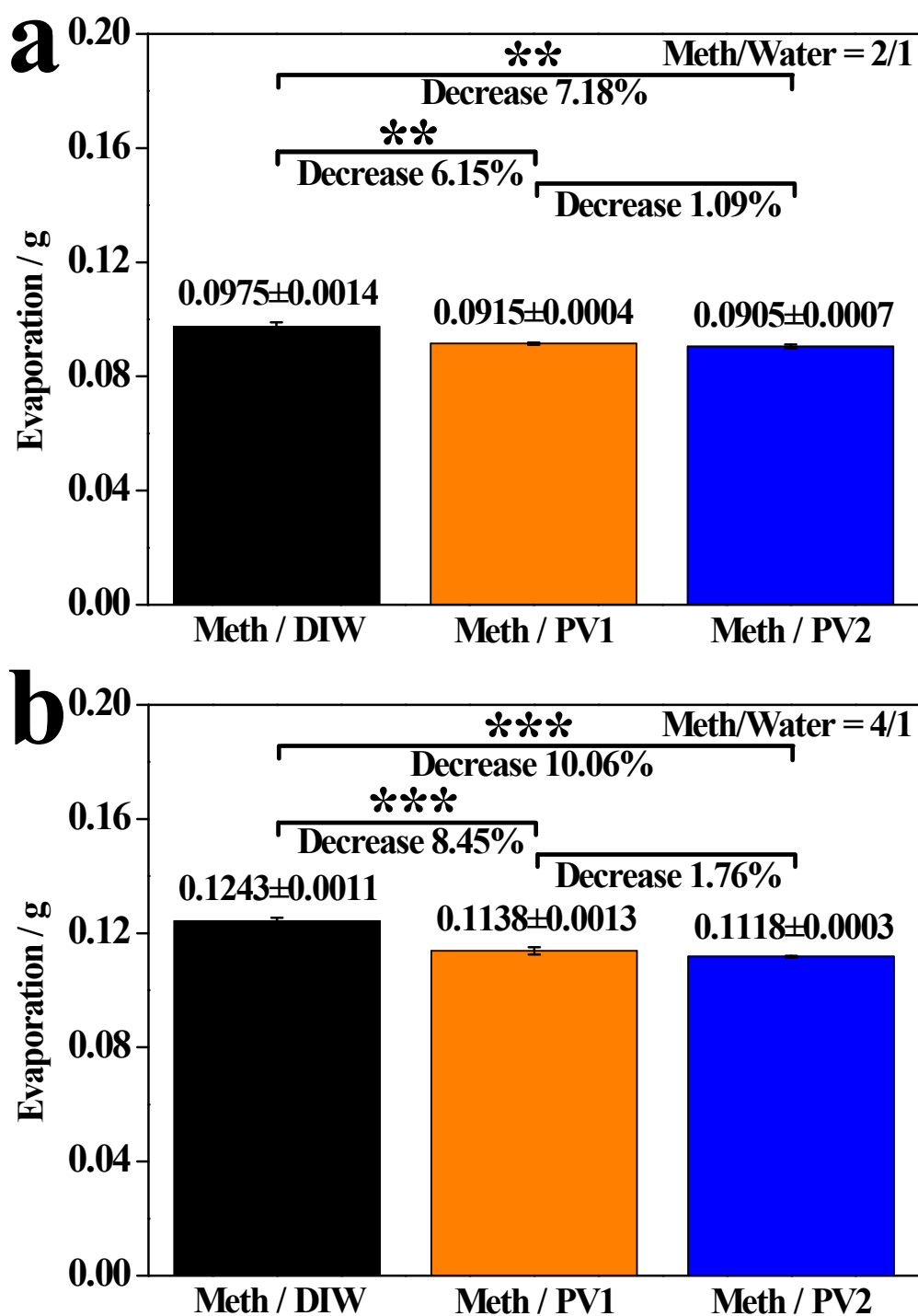


Fig. S3. Evaporation rates of different ratios of methanol (Meth)/deionized water (DIW) (or PV1 or PV2) solutions for 30 min in ambient laboratory air at ca. 55% relative humidity and 25 °C. (a) Ratio of 2:1. (b) Ratio of 4:1. \*\*  $p < 0.01$  and \*\*\*  $p < 0.001$ .

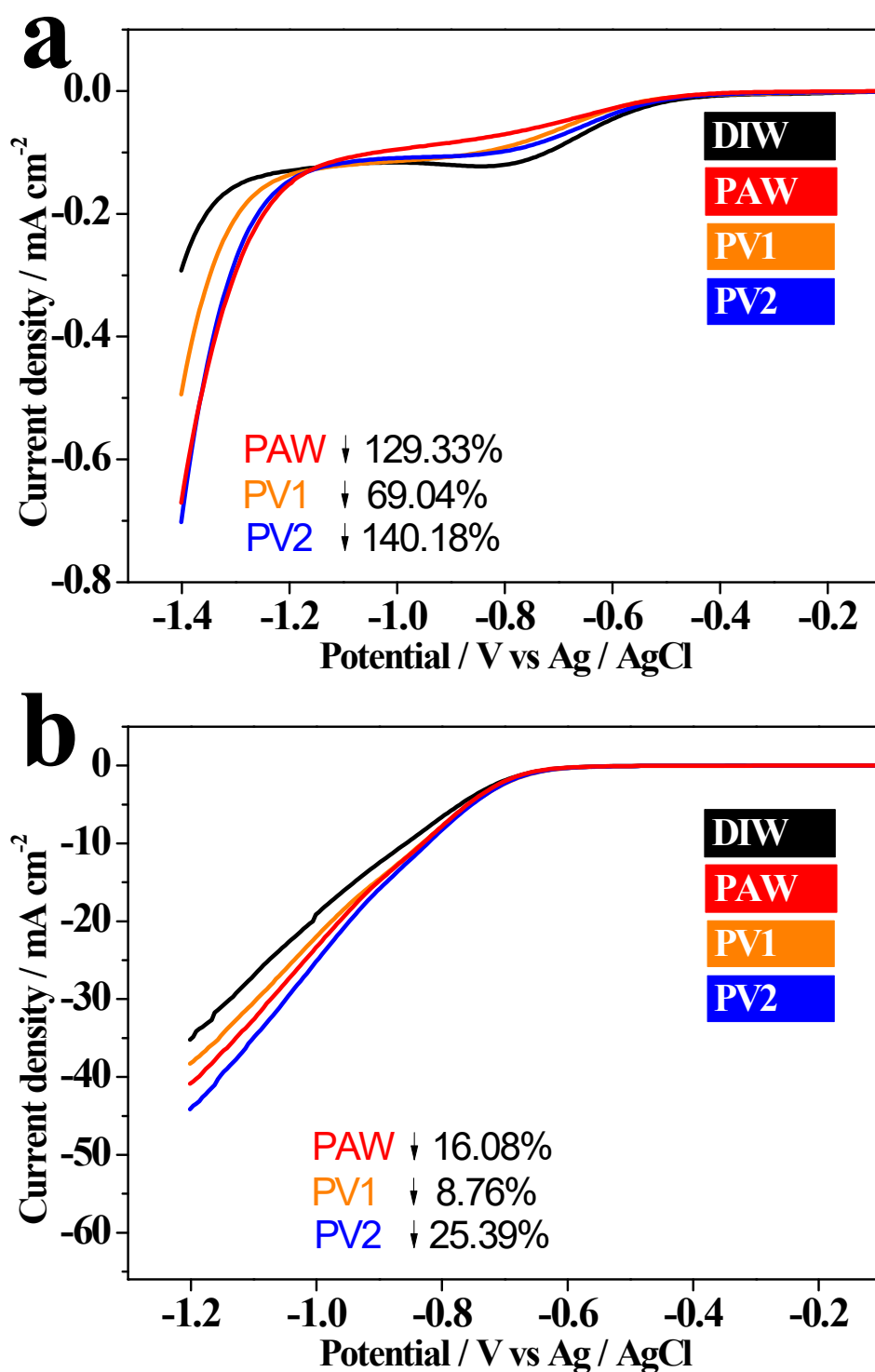


Fig. S4. Linear sweep voltammetry (LSV) recorded on the same inert stainless steel (SS) electrode for hydrogen evolution reactions (HERs) performed in different kinds of water with different electrolytes. (a) In neutral 0.1 N KCl. (b) In acidic 0.1 N H<sub>2</sub>SO<sub>4</sub>.



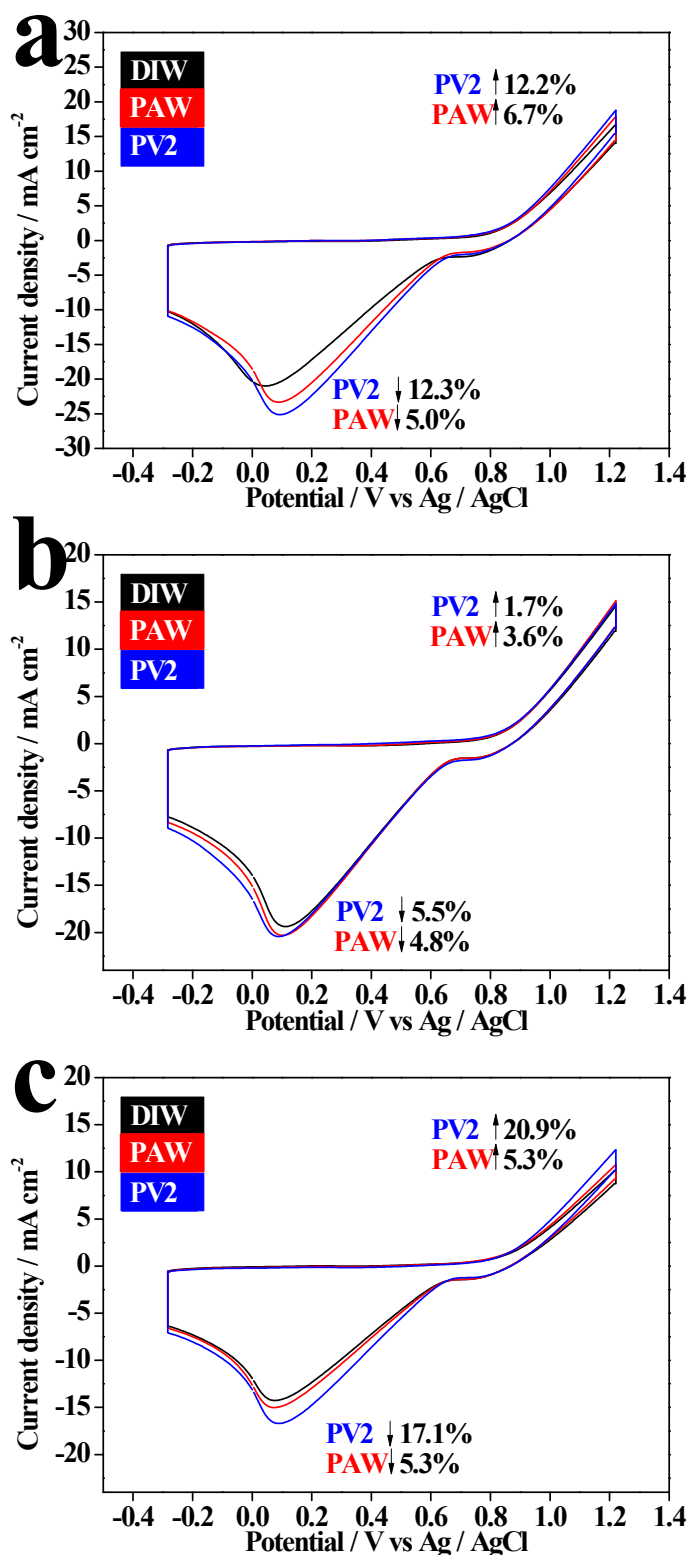


Fig. S5. Oxidation-reduction cycles (ORCs), showing the 25<sup>th</sup> scan, performed in different kinds of water (DIW, PAW and PV2) containing different concentrations of KCl at a scan rate of 500 mV s<sup>-1</sup> on the same Au electrode. (a) In 0.1 N KCl. (b) In 0.09 N KCl. (c) In 0.08 N KCl.