

## Supporting Information

Fig. S1. Synthesis process of SGQDs-CP and PGQDs-CP cathodes.

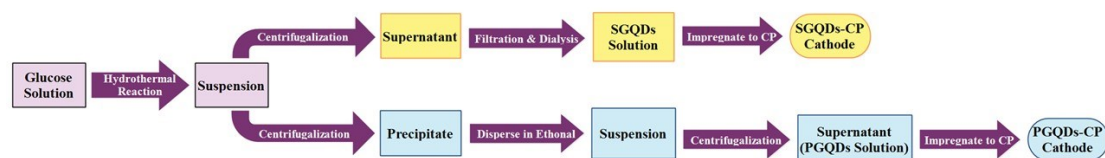


Fig. S2. Raman spectra of SGQDs, PGQDs and UGQDs.

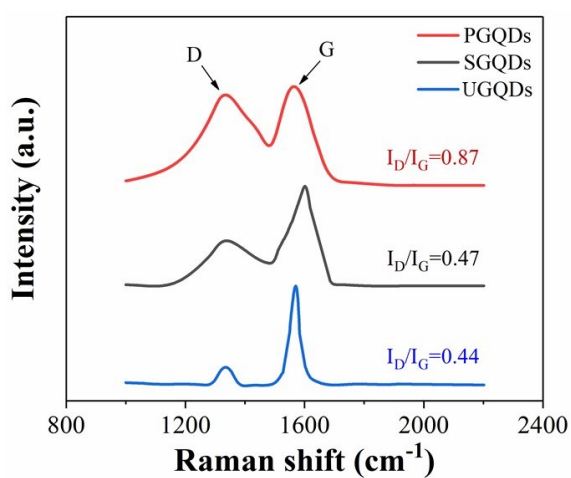


Fig. S3. TEM images for UGQDs.

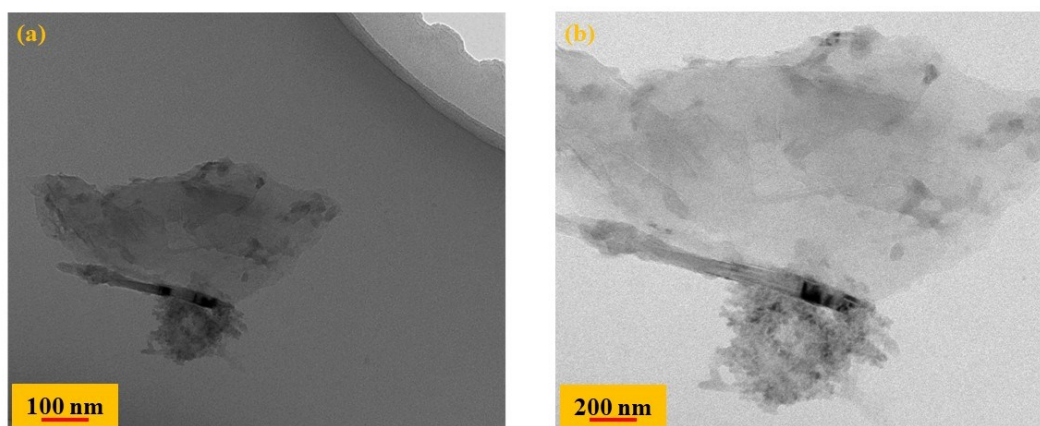


Fig. S4. UV-vis absorption and PL curves of (a) SGQDs and (b) PGQDs.

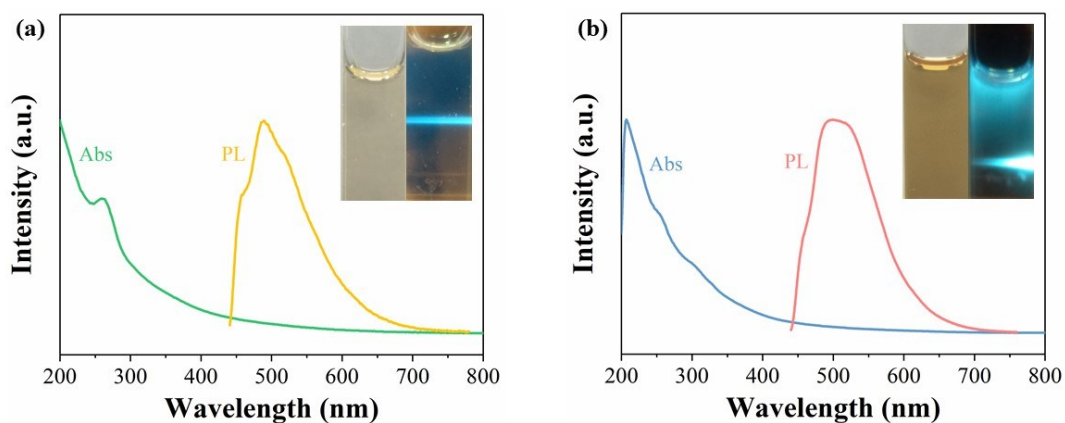


Fig. S5. Bode plots of impedance response of (a) SGQDs-CP and (b) PGQDs-CP cathode at OCV, after full discharge and after full charge states.

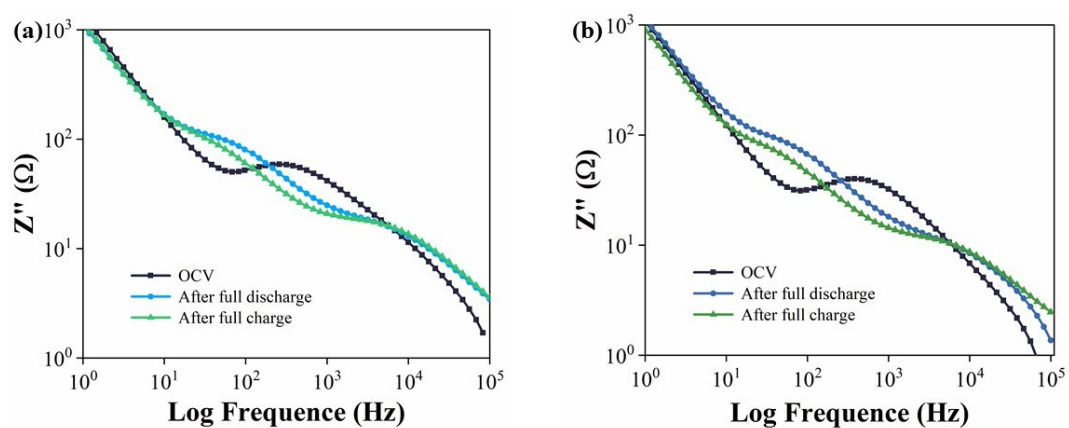


Fig. S6. CV curves of (a) SGQDs and (b) PGQDs at various scan rates (20  $\text{mV s}^{-1}$ -120  $\text{mV s}^{-1}$ ).

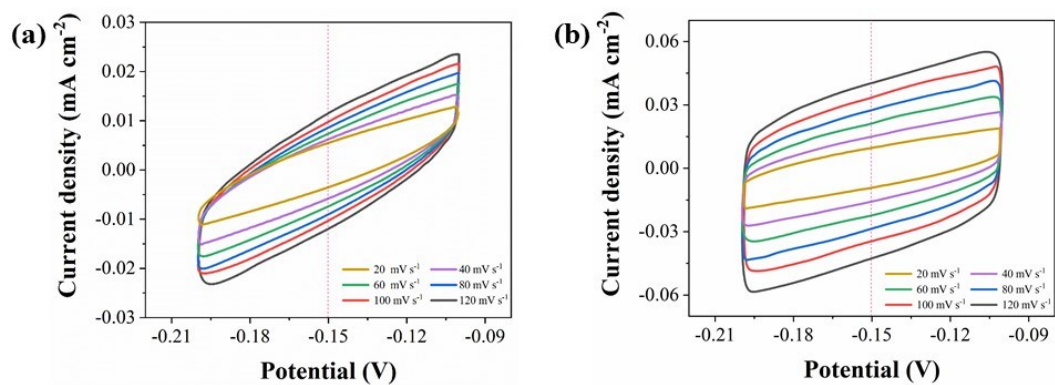


Fig. S7. The comparison of discharge capacity with CP and SGQDs-CP cathodes.

Discharge current: 0.05mA.

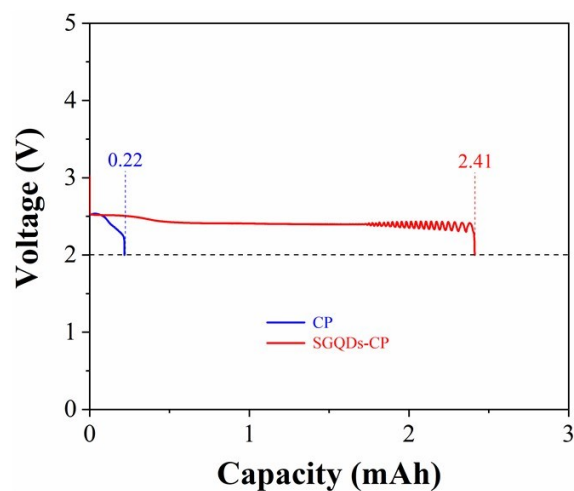


Fig. S8. Optical photos for (a) after dipping the GQDs impregnated cathode in electrolyte solution for 24 h; (b) after dipping the GQDs impregnated cathode in electrolyte solution for 168 h; (c) a GQDs solution in which the amount of it was the same as that in a and b.

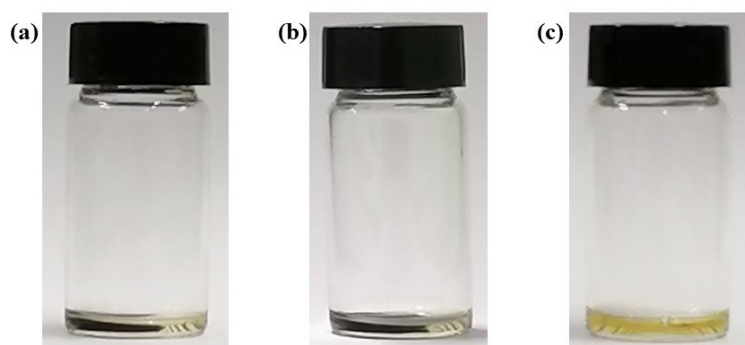


Fig. S9. TEM images of the GQDs after 3 full cycles.

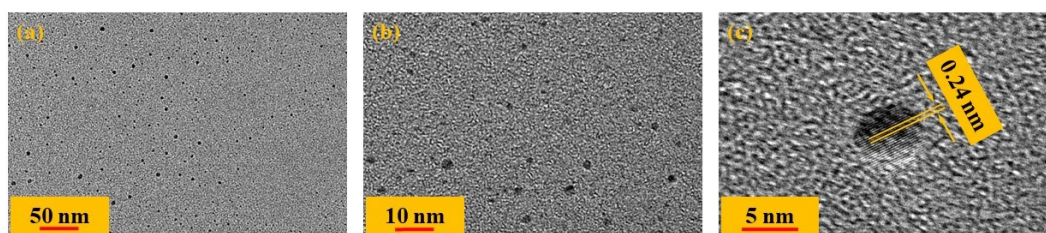


Fig. S10. Photos of the PGQDs solution after being placed for 3 months. (a) 2 h hydrothermal PGQDs, (b) 3 h hydrothermal PGQDs and (c) 6 h hydrothermal PGQDs.

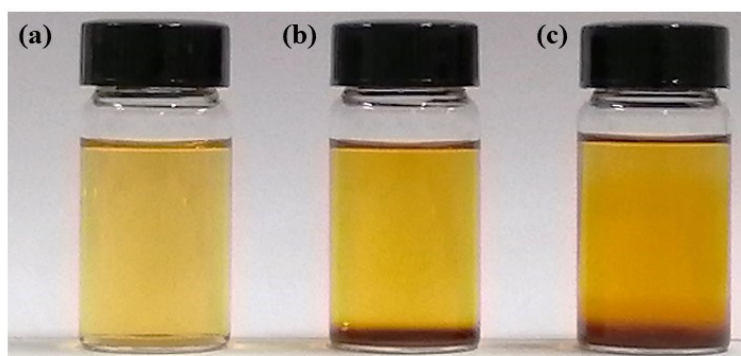


Fig. S11. XPS spectra of the GQDs before and after OER test.

