Supporting Information

One-step synthesis of multi-walled carbon nanotubes/$Ni(OH)_2$ composite as efficient catalysts for water oxidation

Xuemei Zhou,[a] Zhiyun Zhang,[a] Yuanyuan Ma,*[a,b] and Yongquan Qu*[a,b]

[a]Center of Applied Chemical Research, Frontier Institute of Science and Technology, Xi'an Jiaotong University, Xi'an, China 740049. E-mail: yongquan@mail.xjtu.edu.cn, yyma@mail.xjtu.edu.cn.

[b]Institute of Chemistry for New Energy Materials, Department of Chemistry, Xi'an Jiaotong University, Xi'an, China 740049.

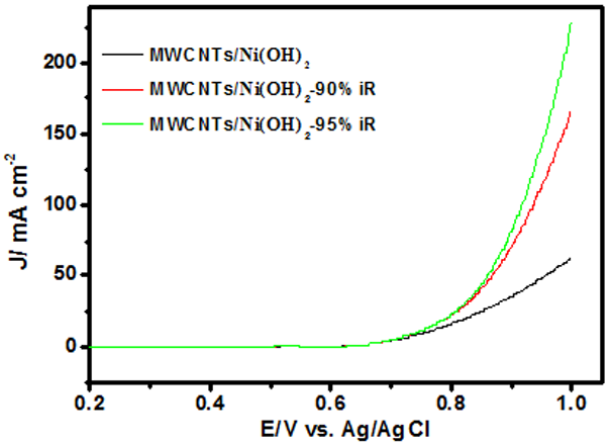

Fig. S1. Polarization curves of MWCNTs/$Ni(OH)_2$ under different iR compensation levels on ITO in pH=13 KOH solution. 95% iR compensation is an optimal level to achieve best curve shape.

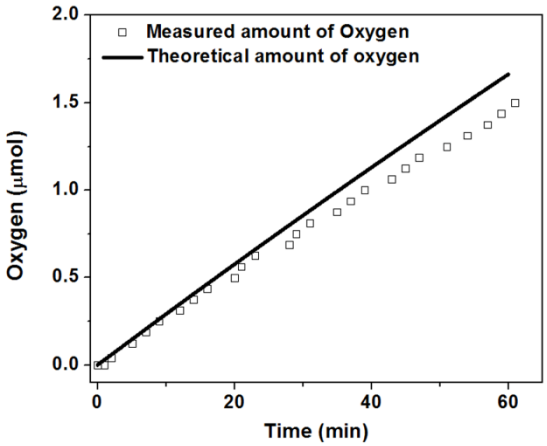

Fig. S2. The oxygen evolution of the composite electrode monitored by a Thermo Scientific Orion Star A213 Benchtop DO Meter.

Oxygen evolution reaction. The generated oxygen was detected by a Thermo Scientific Orion Star A213 Benchtop DO Meter in pH=13 KOH solution. The DO probe was insert into a quartz reactor, together with Pt as counter electrode, Ag/AgCl as reference electrode, and the catalyst loaded on ITO as work electrode. Befor experiment, the electrolyte (200 mL) was under stirring and degassed by argon purging to remove the dissolved oxygen under strong stirring for 30 min.

Calculation of the exchange current densities.

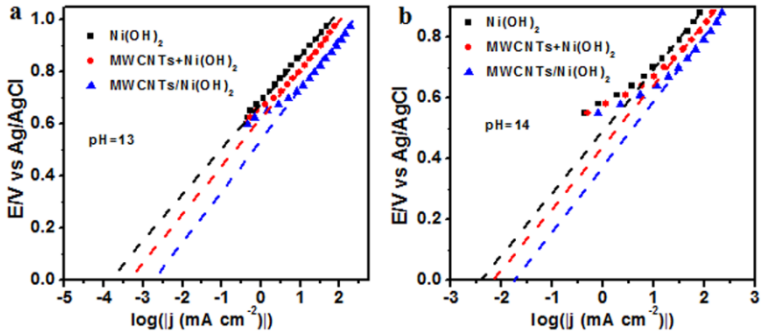

Fig. S3. Calculated exchange current densities of various samples by applying extrapolation method to the Tafel plots in (a) pH=13 and (b) pH=14 KOH solution.

Table S1. Calculated values of the exchange current densities of various samples in pH=13 and pH=14 KOH solution.

	log(| j (mA cm^{-2}) |) at η=0 V		Exchange current density, j_o (μAcm^{-2})	
	pH=13	**pH=14**	**pH=13**	**pH=14**
$Ni(OH)_2$	**-3.85**	**-2.39**	**0.14**	**4.07**
MWCNTs +$Ni(OH)_2$	**-3.35**	**-2.15**	**0.45**	**7.08**
MWCNTs /$Ni(OH)_2$	**-2.70**	**-1.74**	**2.0**	**18.19**

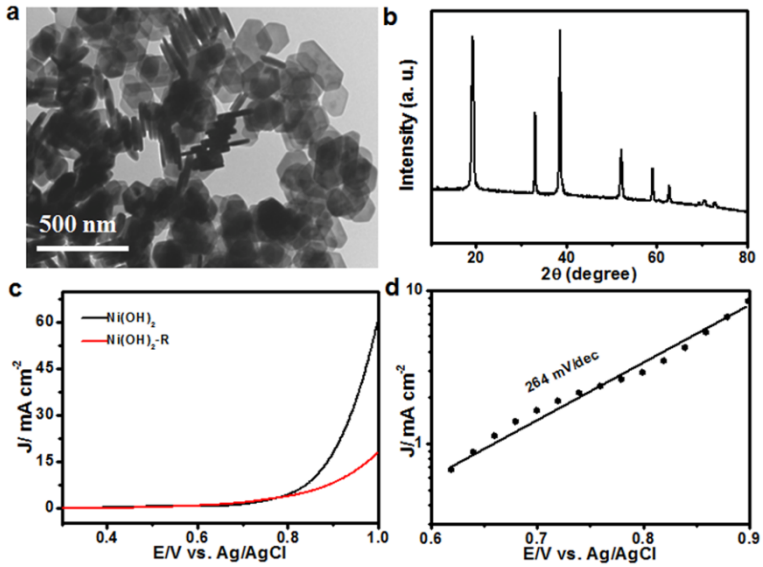

Fig. S4. SEM images (a) and XRD (b) for $Ni(OH)_2$-R; (c) LSV for $Ni(OH)_2$ (black curve) and $Ni(OH)_2$-R (red curve) electrodes in pH 13.0 KOH with 95% iR corrections. The scanning rate was 50 mV/min. (d) Tafel plots of $Ni(OH)_2$-R loaded on ITO recorded in pH=13 KOH, corresponding to the LSV curves in Fig. S3c.

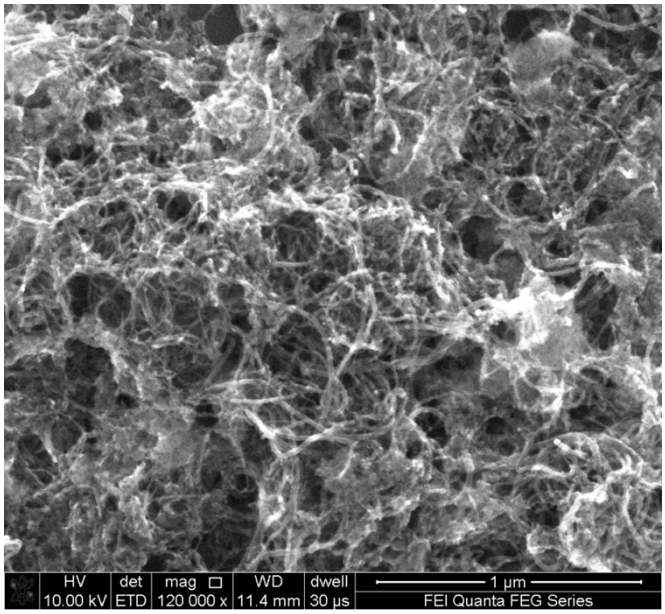

Fig. S5. SEM images for MWCNTs/$Ni(OH)_2$.

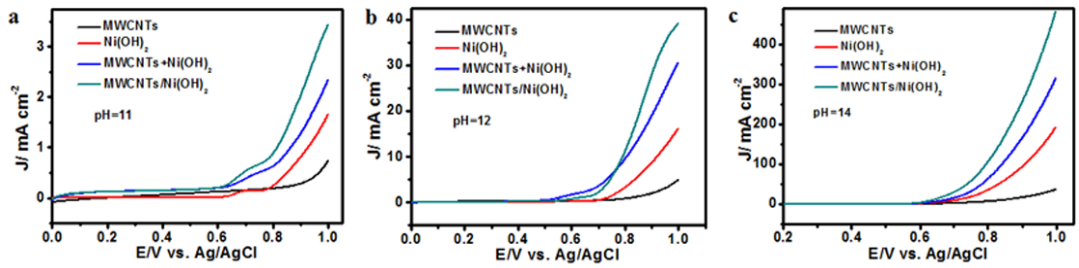

Fig. S6. Linear sweep voltammograms of all catalytic electrodes in pH=11 (a), pH=12 (b) and pH=14 (c) KOH with 95% iR corrections.

Calculation of TOF. Turnover frequency (TOF) value is calculated from the equation:

$$TOF = \frac{J * A}{4 * F * m}$$

J (A cm^{-2}) is the current density at a specified overpotential. A is the area of the ITO electrode. F is the faraday constant (96485 C mol^{-1}). The m is the number of moles of the active materials loaded onto the ITO.