Electronic Supplementary Information

Preparation of metal oxide/polyaniline/N-MWCNT hybrid composite electrodes for electrocatalytic synthesis of ammonia at atmospheric pressure

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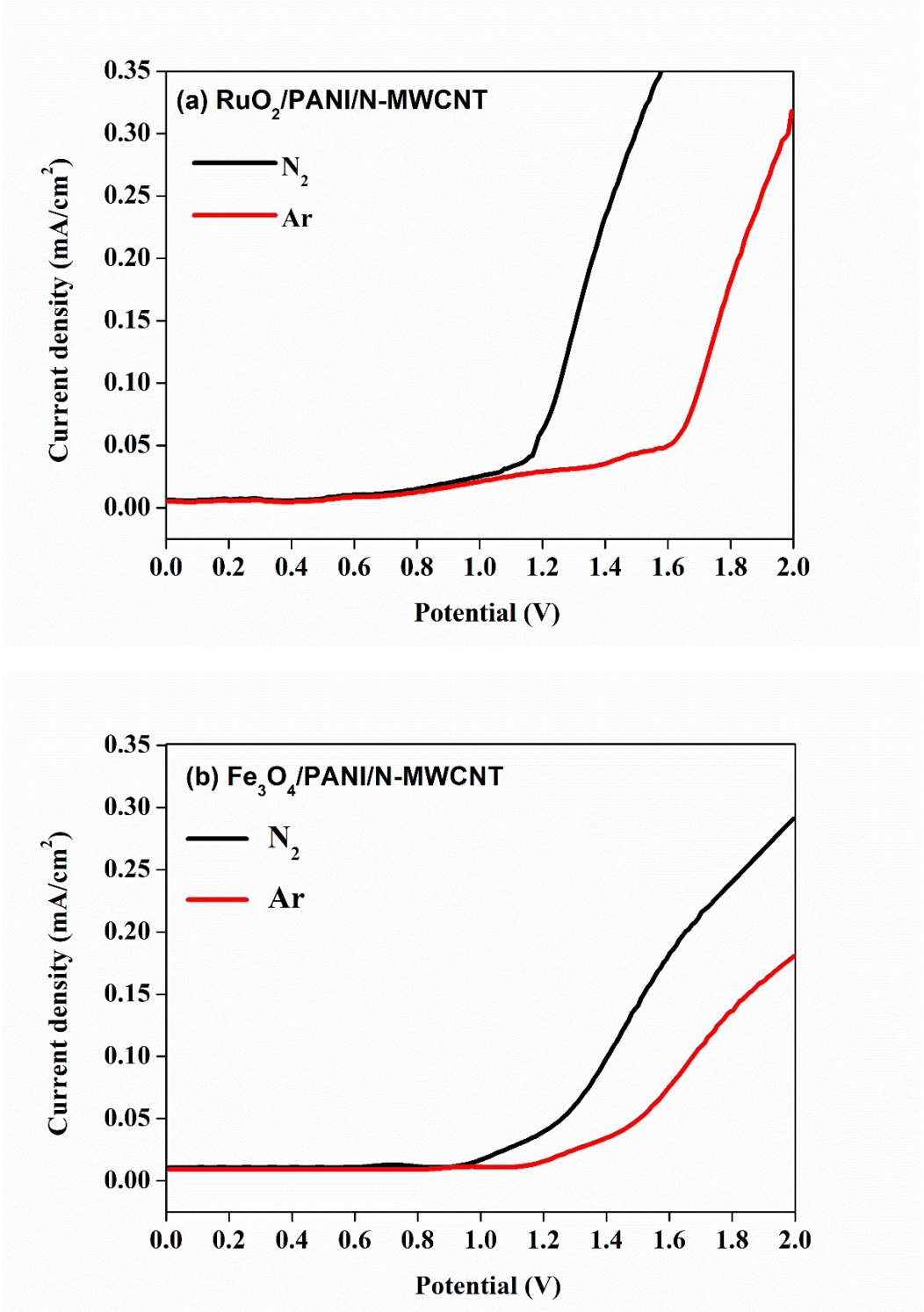
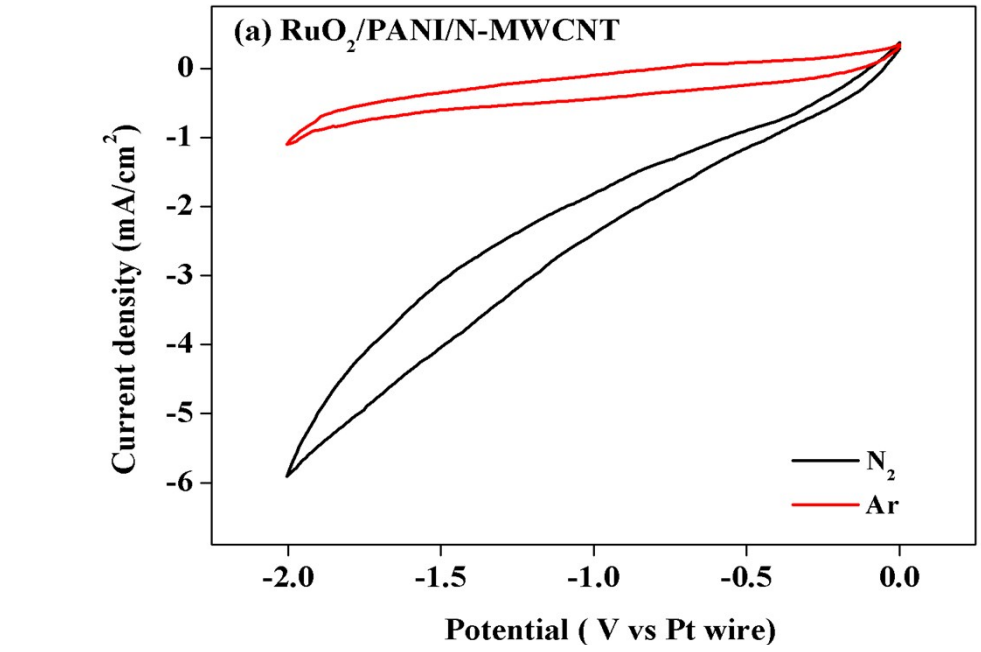


Fig. S1. LSV curves for (a) RuO_2/PANI/N-MWCNT and (b) Fe_3O_4/PANI/N-MWCNT electrocatalysts in the presence of argon and nitrogen.



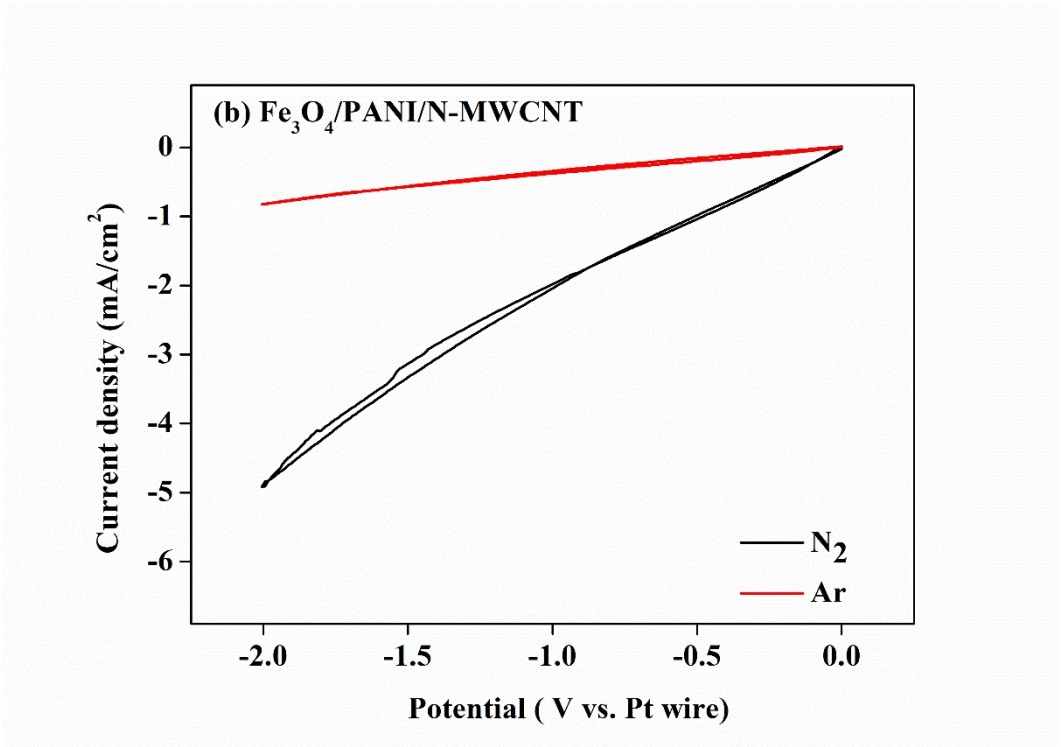


Fig. S2. CV curves for (a) RuO_2/PANI/N-MWCNT and (b) Fe_3O_4/PANI/N-MWCNT electrocatalysts in the presence of argon and nitrogen.

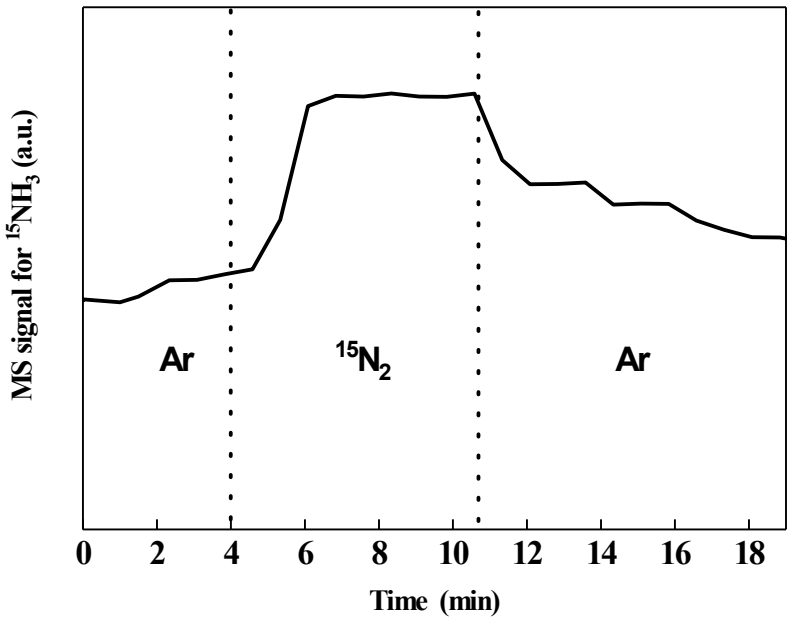


Fig. S3. Mass spectrometer signal of m/z=18 for $^{15}NH_3$ from the electrolytic cell with RuO_2/PANI/N-MWCNT during potentiostatic electrolysis with supply of Ar or $^{15}N_2$ at a cell voltage of 1.2 V and 25°C.

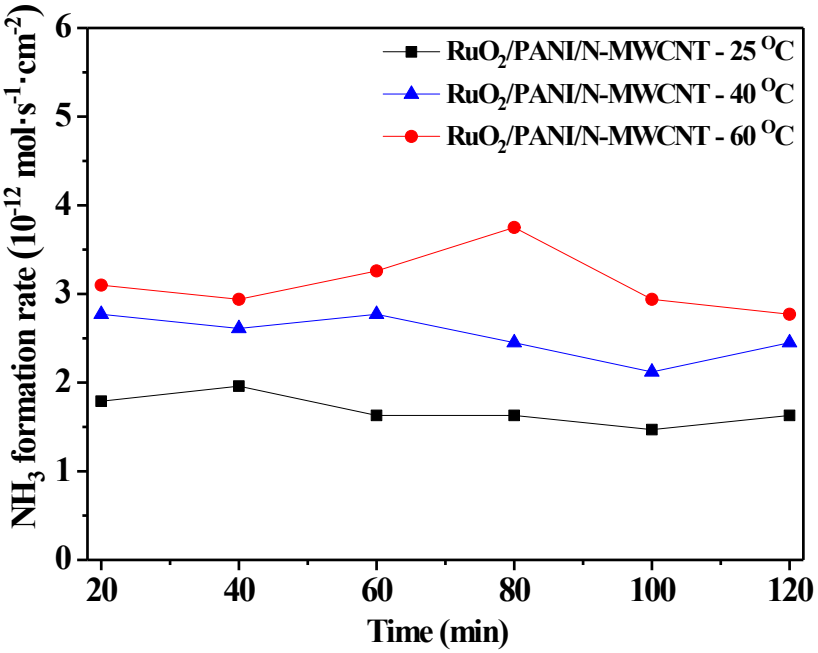


Fig. S4. Results of continuous N_2 reduction over 2 h using an electrolysis cell with RuO_2/PANI/N-MWCNT in the temperature range of 25–60°C at an applied potential of 1.2 V.

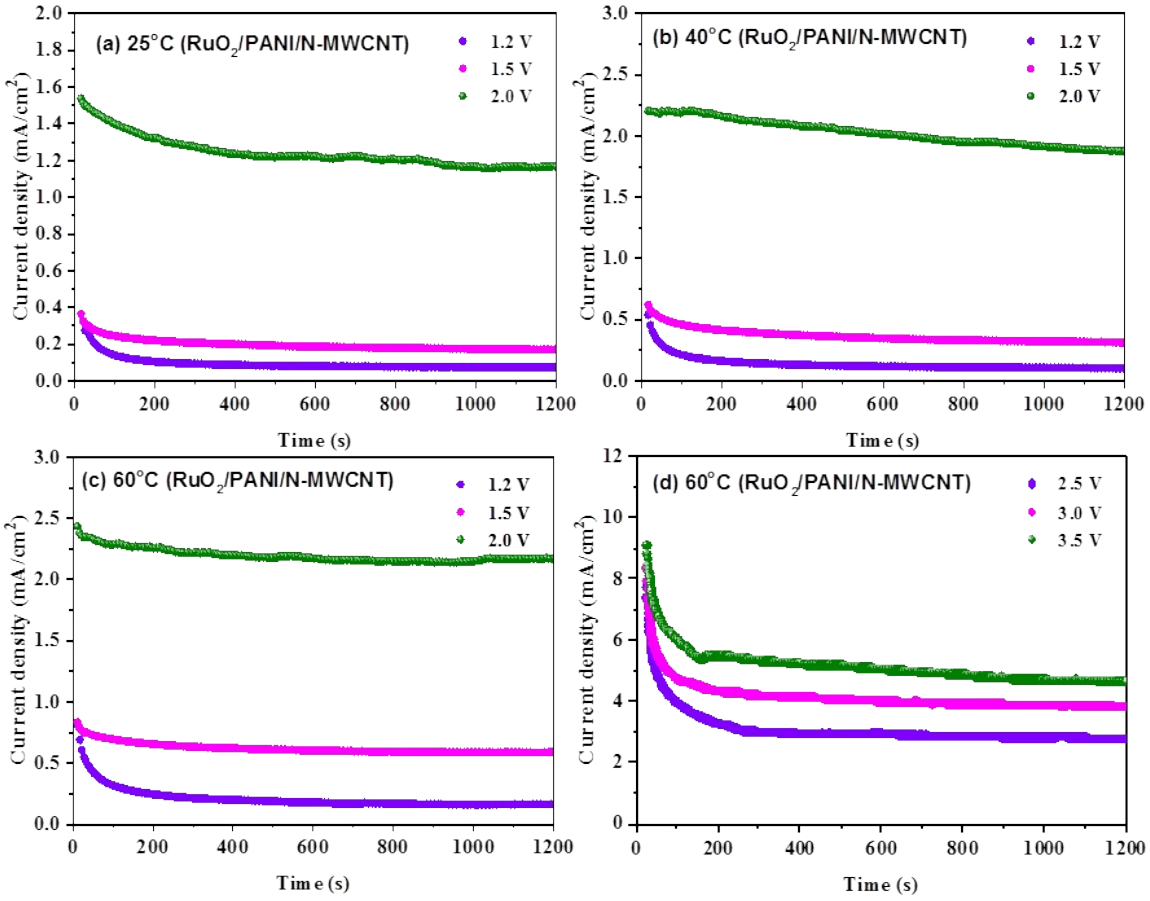


Fig. S5. Trend of current density versus time for theRuO_2/PANI/N-MWCNT electrocatalyst at different temperatures.

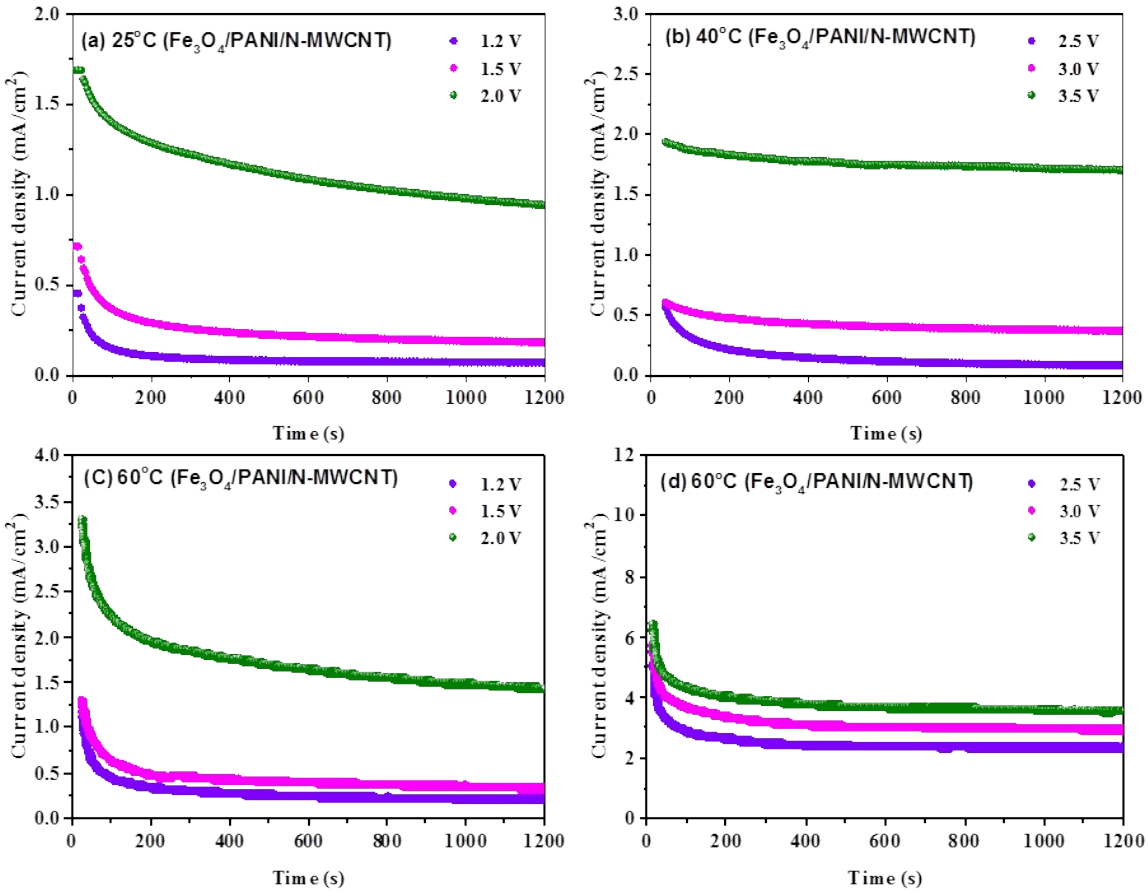


Fig. S6. Trend of current density versus time for the Fe_3O_4/PANI/N-MWCNT electrocatalyst at different temperatures.

Table S1. Overall faradaic efficiencies (H_2+NH_3) from the RuO_2/PANI/N-MWCNT electrocatalyst under an applied potential of 1.2 – 2.0 V at 25°C

Applied potential (V)	FE H_2 (%)	FE NH_3 (%)	Overall FE
1.2	98.11	0.49	98.6
1.5	97.27	0.34	97.61
2.0	94.53	0.07	94.60

*Definition of faradaic efficiency of hydrogen production:

$$FE_{H_2}(\%) = \frac{R_{H2}(mol \cdot cm^{-2} \cdot s^{-1}) \times t(s) \times S(cm^{-2}) \times F}{2 \times I(A) \times t(s)} \times 100\%$$

where R_{H2} is the hydrogen produced per electrode area (S) and time (t), I (A) is the average current during the reaction, and F is the Faraday constant.