Electronic Supplementary Information

Binary transition metal nitrides with enhanced activity and durability for the oxygen reduction reaction

Xinlong Tian, Junming Luo, Haoxiong Nan, Zhiyong Fu, Jianhuang Zeng, Shijun Liao[1]

The Key Laboratory of Fuel Cell Technology of Guangdong Province & The Key Laboratory of New Energy Technology of Guangdong Universities, School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou 510641, China

[1] Corresponding author, email: chsjliao@scut.edu.cn, fax +86 20 8711 3586

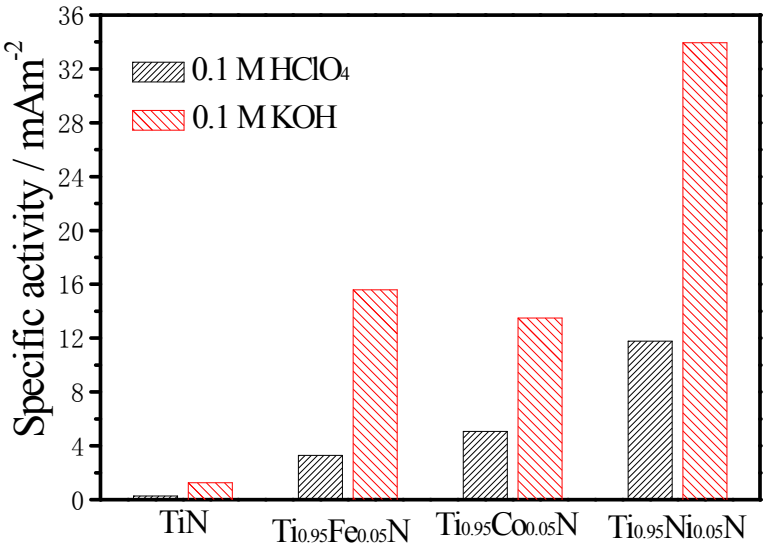

Fig. S1. The specific activity (current density was normalized to the BET surface area) of TiN and the BTMN catalysts in both 0.1 M $HClO_4$ and 0.1 M KOH at 0.7 V.

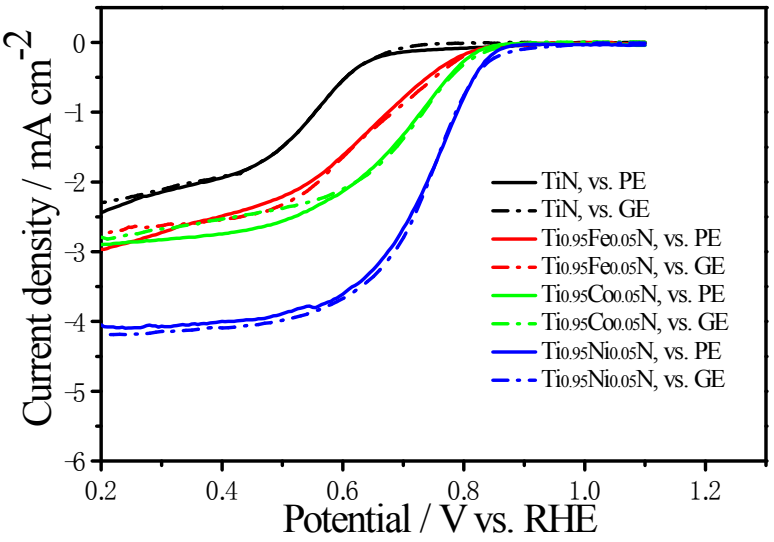

Fig. S2. Linear sweep voltammetry curves of TiN, $Ti_{0.95}Fe_{0.05}N$, $Ti_{0.95}Co_{0.05}N$, and $Ti_{0.95}Ni_{0.05}N$ in O_2-saturated 0.1 M $HClO_4$ with a platinum wire as counter electrode (solid curves, PE), and a graphite rod as the counter electrode (dash curves, GE), respectively, at a scan rate of 10 mvs^{-1}.

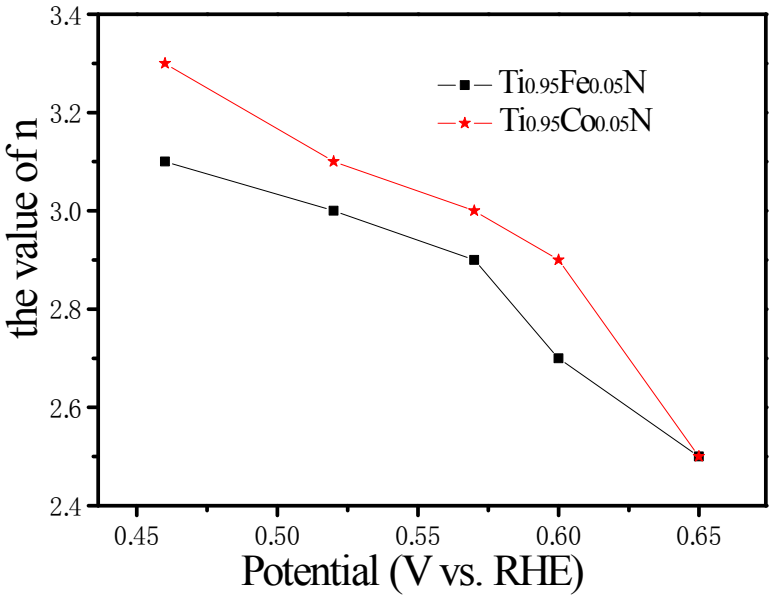

Fig. S3. The electron transfer number, n, of $Ti_{0.95}Fe_{0.05}N$ and $Ti_{0.95}Co_{0.05}N$ catalysts were derived from the slopes of the Koutecky–Levich plots at various potentials.

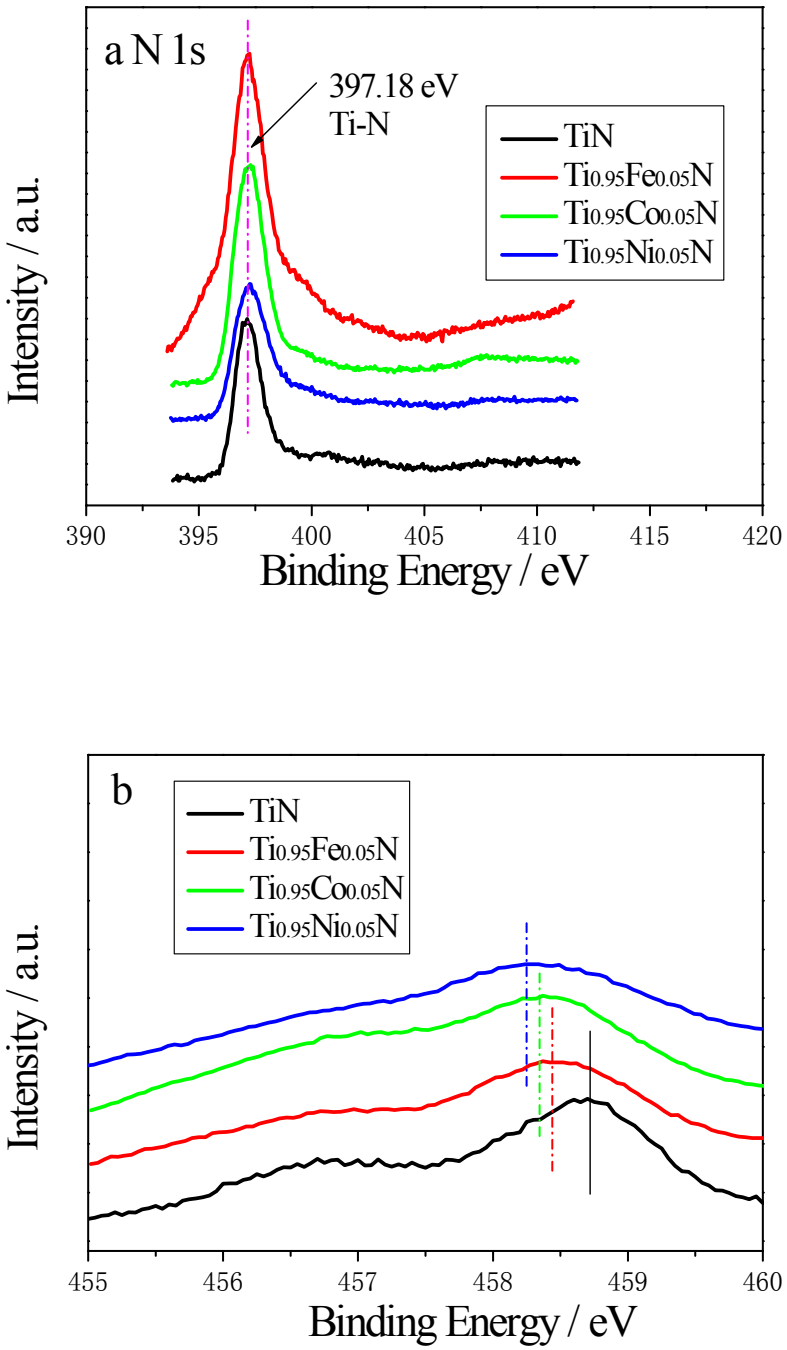

Fig. S4. (a) High-resolution N 1s spectra, and (b) the enlarged Ti $2p_{3/2}$ part of TiN, $Ti_{0.95}Fe_{0.05}N$, $Ti_{0.95}Co_{0.05}N$, and $Ti_{0.95}Ni_{0.05}N$, respectively.

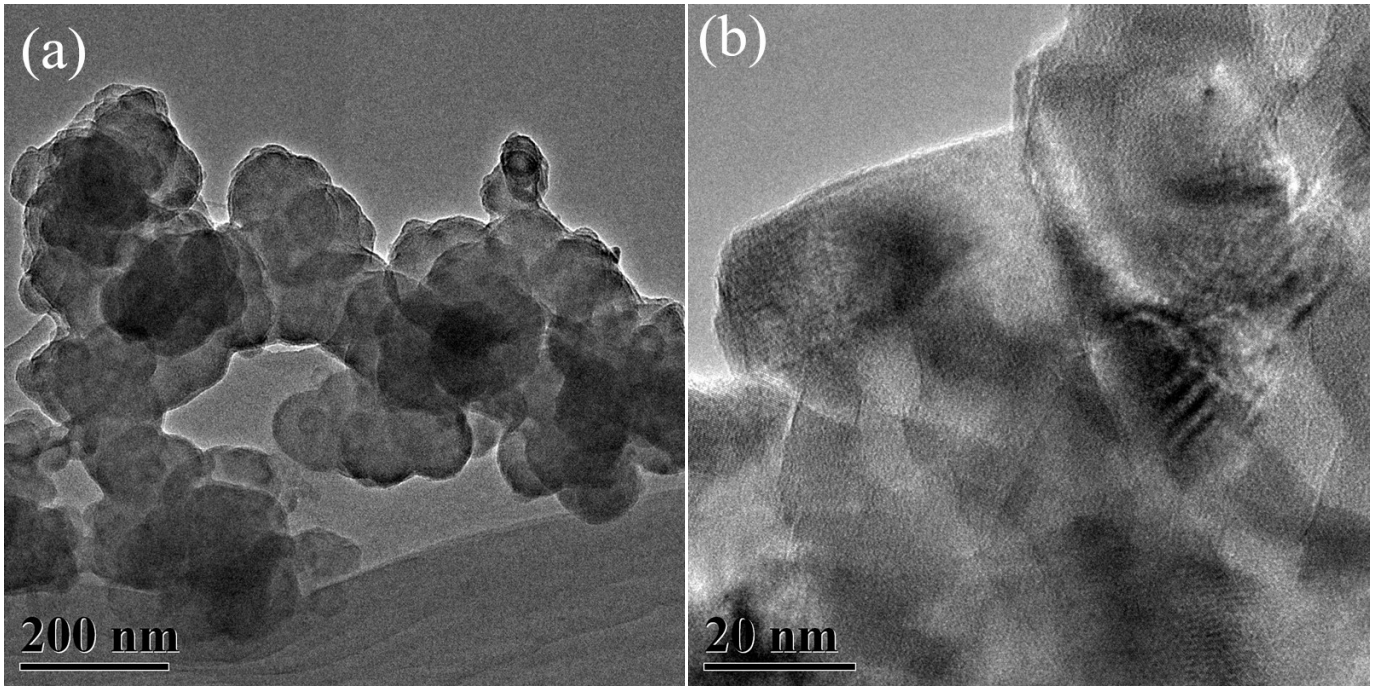

Fig. S5. (a) TEM image of and enlarged TEM image of $Ti_{0.95}Ni_{0.05}N$ annealed at 800°C

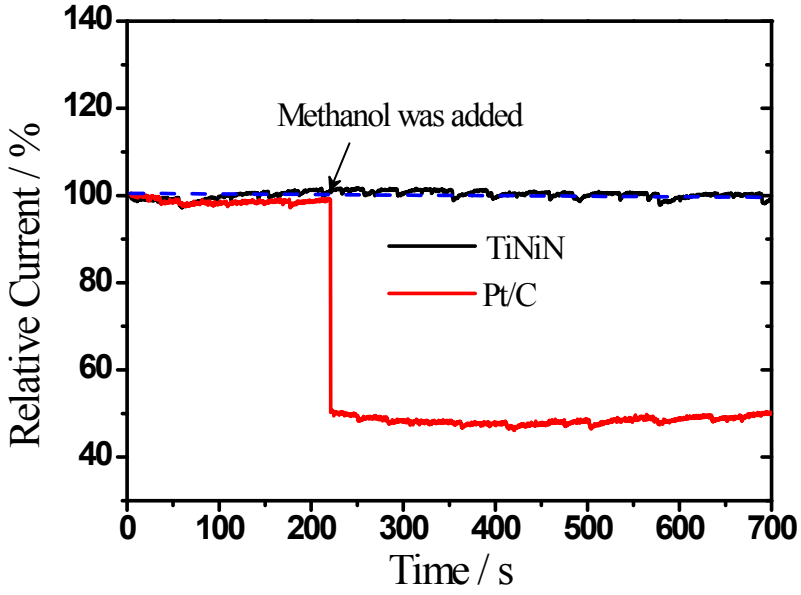

Fig. S6. Chronoamperometric response for ORR of $Ti_{0.95}Ni_{0.05}N$ and Pt/C electrodes with the addition of methanol to the electrolyte after about 230 s at 0.7 V.

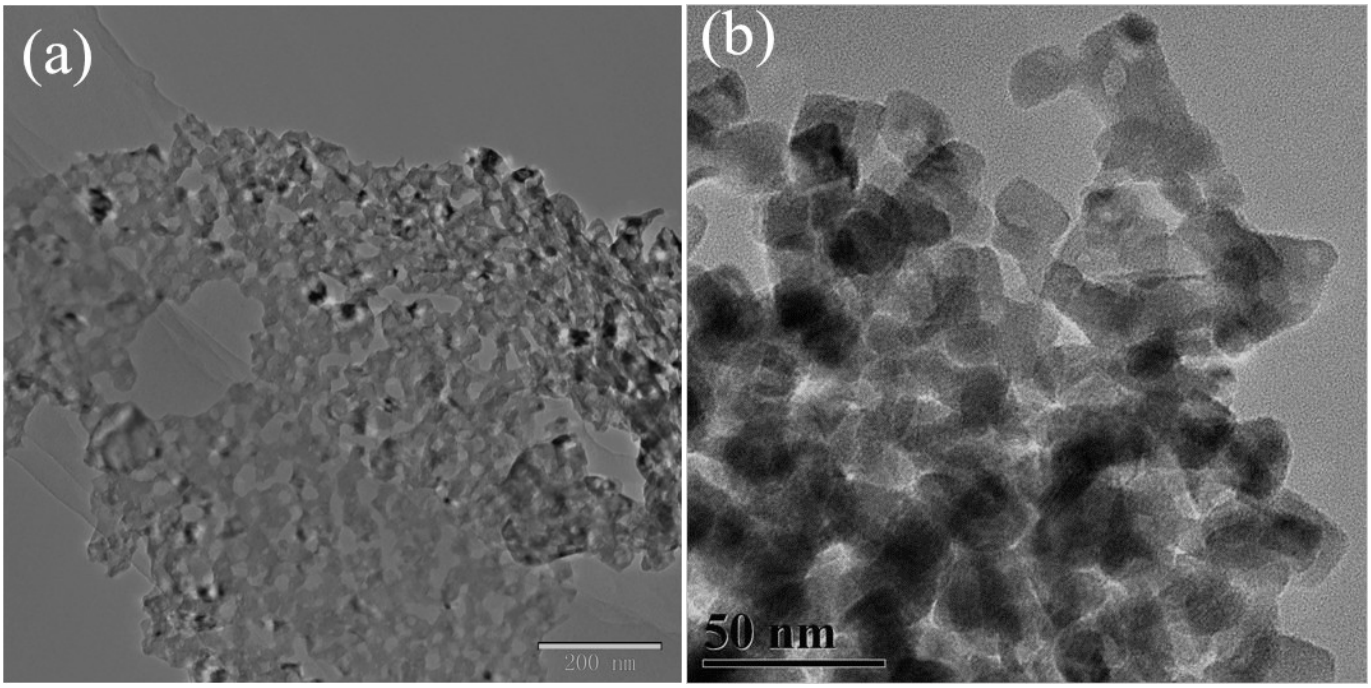

Fig. S7. (A) TEM and (b) enlarged TEM images of $Ti_{0.95}Ni_{0.05}N$ after the durability test.

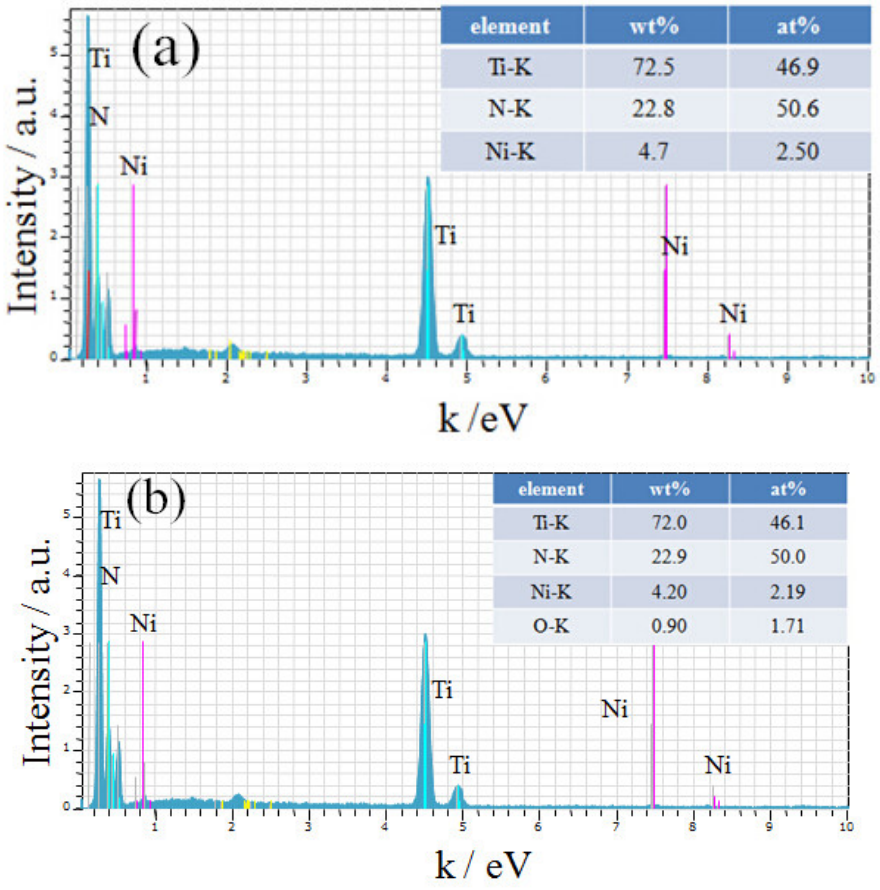

Fig. S8. The EDX profiles of $Ti_{0.95}Ni_{0.05}N$ catalyst (a) before and (b) after the durability test.

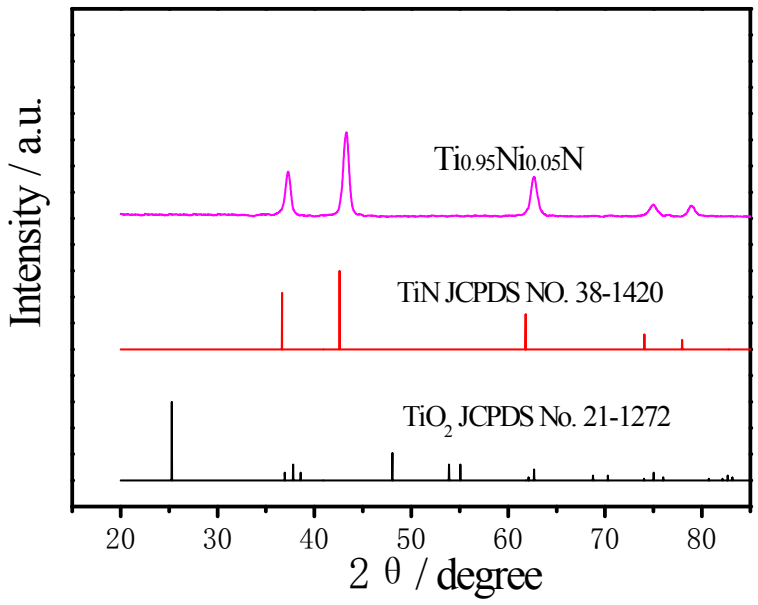

Fig. S9. XRD pattern of $Ti_{0.95}Ni_{0.05}N$ after the durability test.