Electronic Supplementary Information (ESI)
Nano-sized layered aluminium or zinc-manganese oxides as efficient and biomimetic water oxidizing catalysts†‡

Mohammad Mahdi Najafpour¹,²*, Babak Pashaei¹ and Sara Nayeri¹

¹Department of Chemistry, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, 45137-66731, Iran

²Center of Climate Change and Global Warming, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, 45137-66731, Iran

*Corresponding author; Phone: (+98) 241 415 3201; E-mail: mmnajafpour@iasbs.ac.ir
Table of Contents

The reactor set-up for oxygen evolution experiment ..................Page 4
SEM Images..............................................................................Page 5
TEM Images.............................................................................Page 32
FTIR Spectra............................................................................Page 36
DLS Results...............................................................................Page 54
XRD Results.............................................................................Page 55
Material and methods

All reagents and solvents were purchased from commercial sources and were used without further purification. TEM and SEM were carried out with Philips CM120 and LEO 1430VP, respectively. The X-ray powder patterns were recorded with a Bruker, D8 ADVANCE (Germany) diffractometer (Cu-Kα radiation). Manganese atomic absorption spectroscopy (AAS) was performed on an Atomic Absorbtion Spectrometer Varian Spectr AA 110. Prior to analysis, the oxide (10.0 mg metal) were added to 1 mL of concentrated nitric acid and H₂O₂, left at room temperature for at least 1 h to ensure that the oxides were completely dissolved. The solutions were then diluted to 25.0 mL and analyzed by AAS.
Fig. S1. The reactor set-up for oxygen evolution experiment in the presence of Ce(IV).
Fig. S2 SEM images of zinc - manganese oxides prepared at 100 °C (a-g).
Fig. S3. SEM images of zinc - manganese oxides prepared at 300°C (a-f).
Fig. S4. SEM images of zinc-manganese oxides prepared at 600 °C (a-f).
(a)

(b)
Fig. S5. SEM images of zinc-manganese oxides prepared at 1000 °C (a-g).
Fig. S6 SEM images of aluminium - manganese oxides prepared at 100 °C (a-g).
(a)

(b)
Fig. S7 SEM images of aluminium - manganese oxides prepared at 300 °C (a-f).
Fig. S8 SEM images of aluminium - manganese oxides prepared at 500 °C (a-f).
Fig. S9 SEM images of aluminium - manganese oxides prepared at 750 °C (a-f).
Fig. S10 TEM images of zinc - manganese oxides prepared at 300 °C (a-e).
Fig. S11 TEM images of aluminium - manganese oxides prepared at 300 °C (a-e).
(a)
(d)
(f)
Fig. S12 FTIR spectra of zinc-manganese oxides prepared at 100 (a), 200 (b), 300 (c), 400 (d), 450 (e), 550 (f), 600 (g), 750 (h) and 1000 (k) °C.
Transmittance [%]

Wavenumber cm⁻¹

4000 3500 3000 2500 2000 1500 1000 500

(a)
(c)
Electronic Supplementary Material (ESI) for Dalton Transactions

This journal is © The Royal Society of Chemistry 2012

(d)
Electronic Supplementary Material (ESI) for Dalton Transactions
This journal is © The Royal Society of Chemistry 2012
(g)
Fig. S13 FTIR spectra of aluminium - manganese oxides prepared at 100 (a), 200 (b), 300 (c), 400 (d), 450 (e), 550 (f), 600 (g), 750 (h) and 1000 (k) °C.
Fig. S14 DLS results for aluminium (a) or zinc (b) - manganese oxides prepared at 300 °C.
Fig. S15 XRD patterns of the obtained nano-sized layered aluminium - manganese oxides prepared at 100 (black), 300 (red) and 750 (green) °C.
Fig. S16 XRD patterns of the obtained nano-sized layered zinc - manganese oxides prepared at 100 (black), 300 (red) and 700 (green) °C.