Electronic Supplementary Material (ESI) for New Journal of Chemistry

Support Information

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Amorphous manganese oxide-coated montmorillonite as an efficient catalyst for water oxidation

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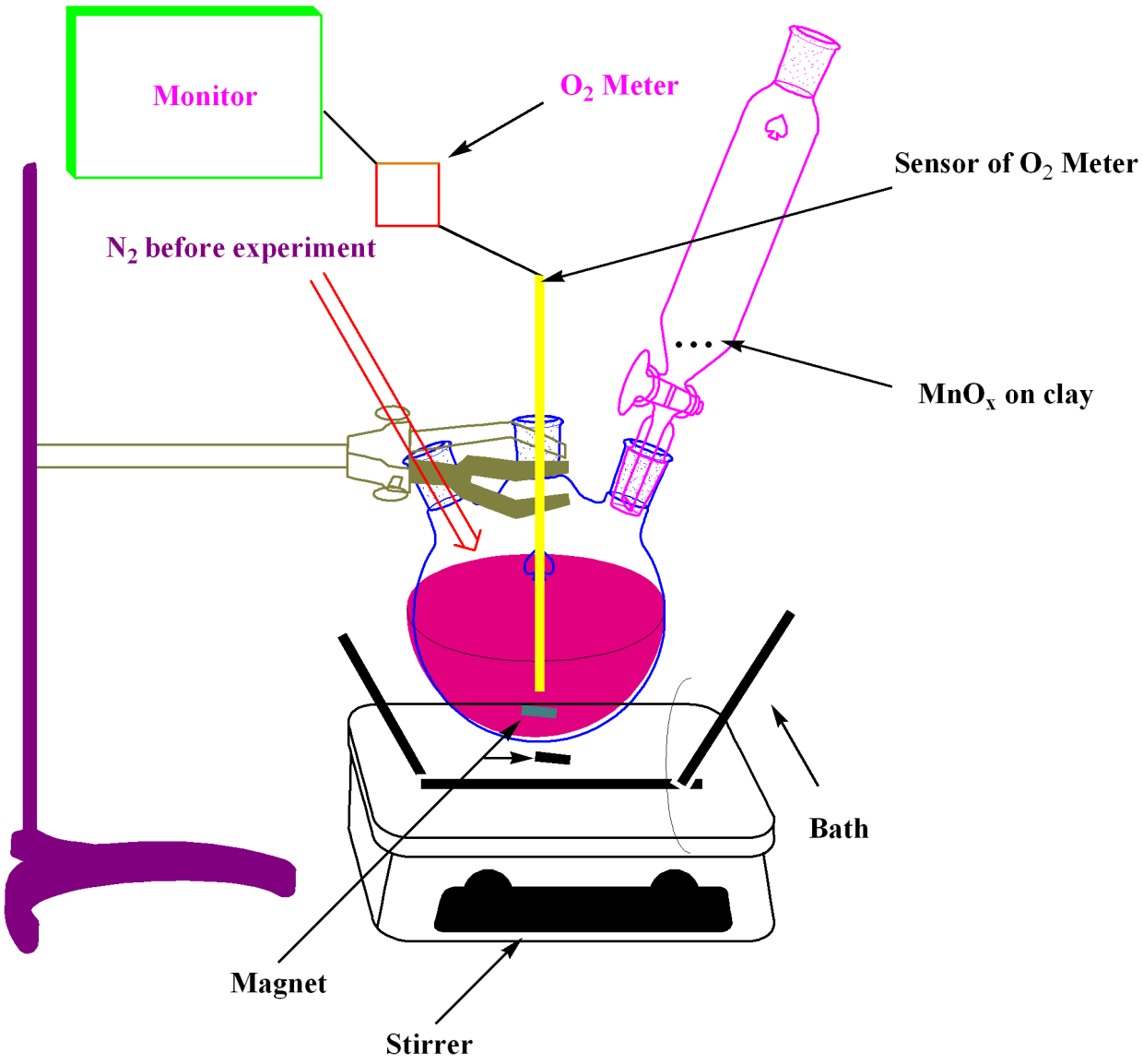
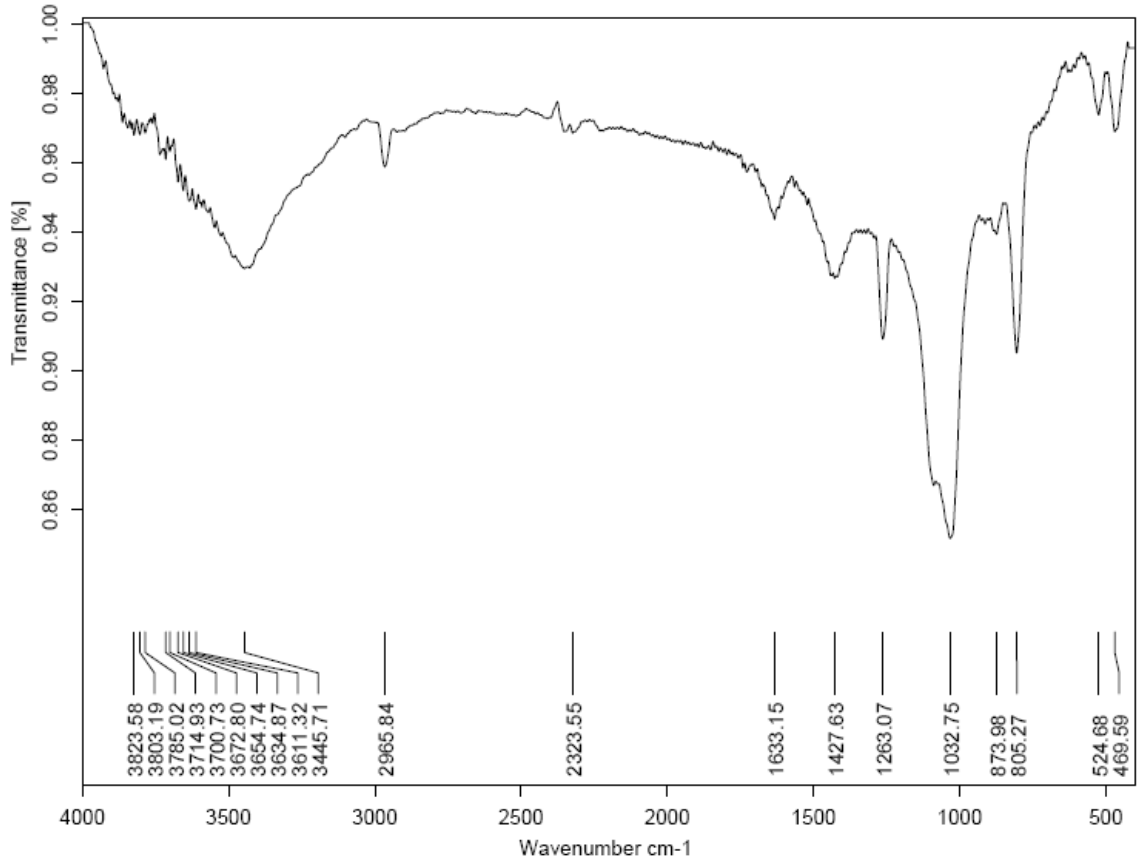
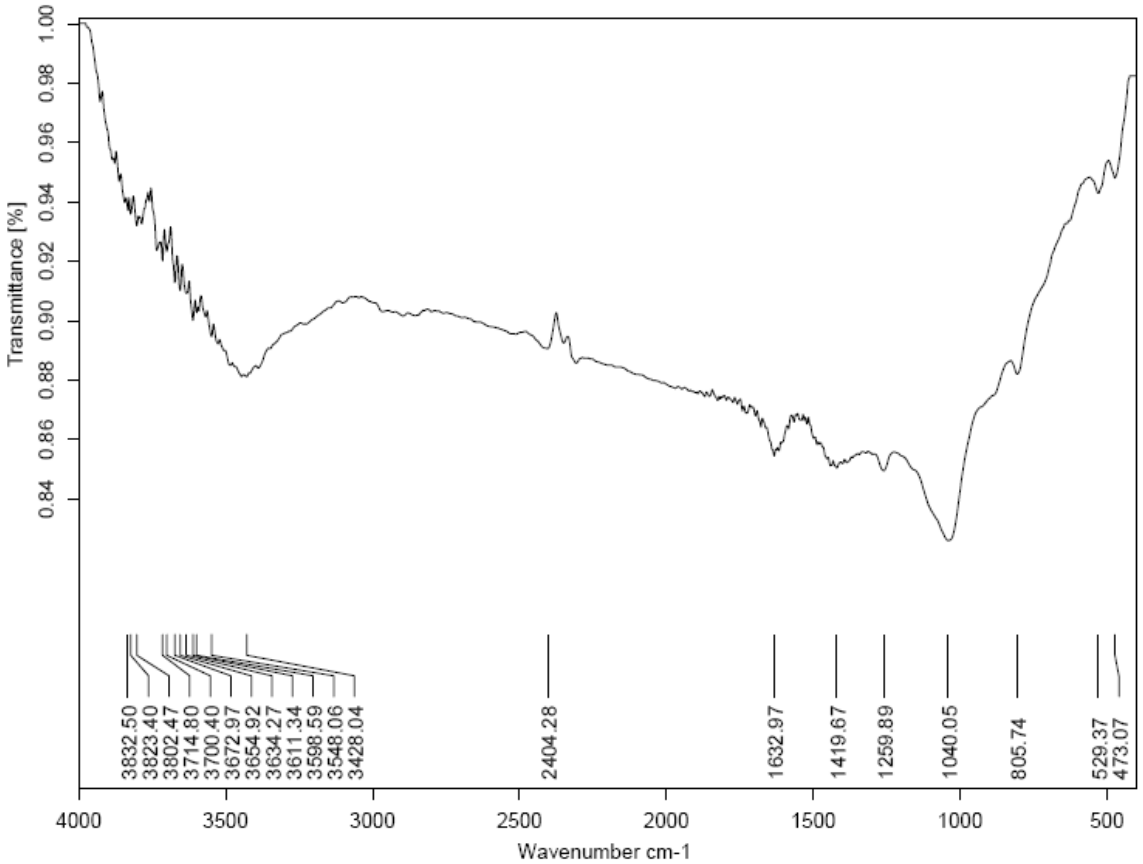


Fig. S1. The reactor set-up for oxygen evolution experiment from aqueous solution in the presence of $(NH_4)_2Ce(NO_3)_6$ (Ce(IV)) and catalyst.



a



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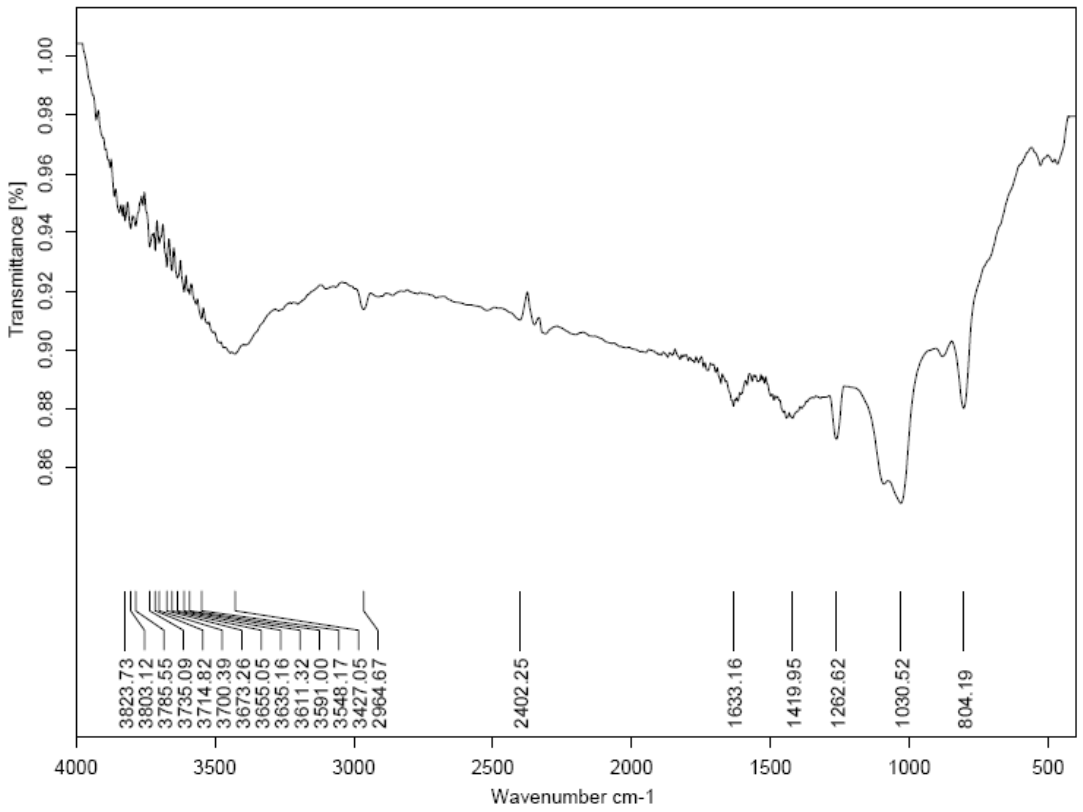

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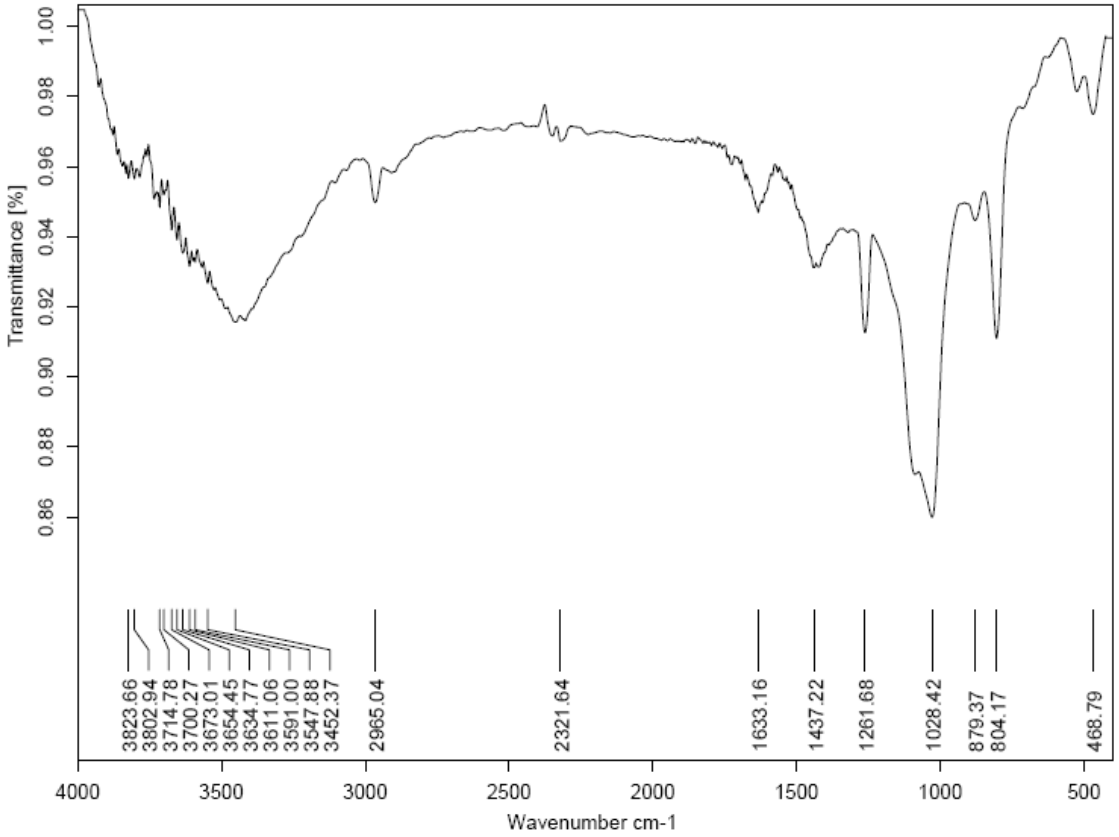

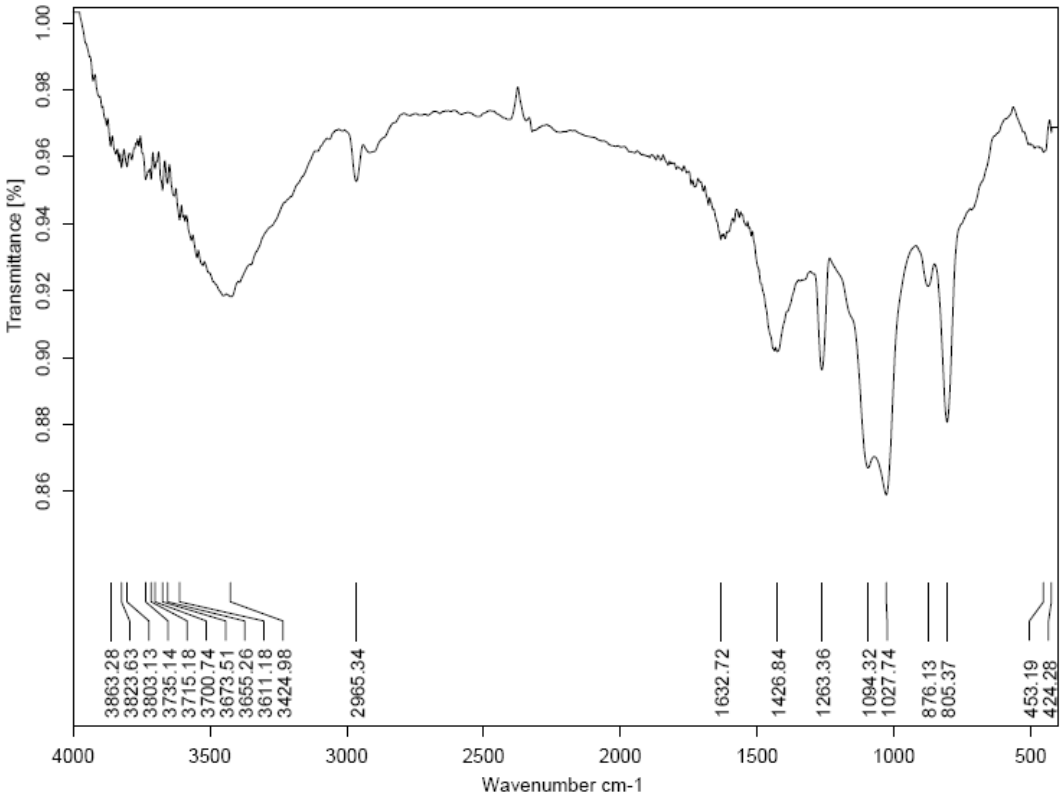

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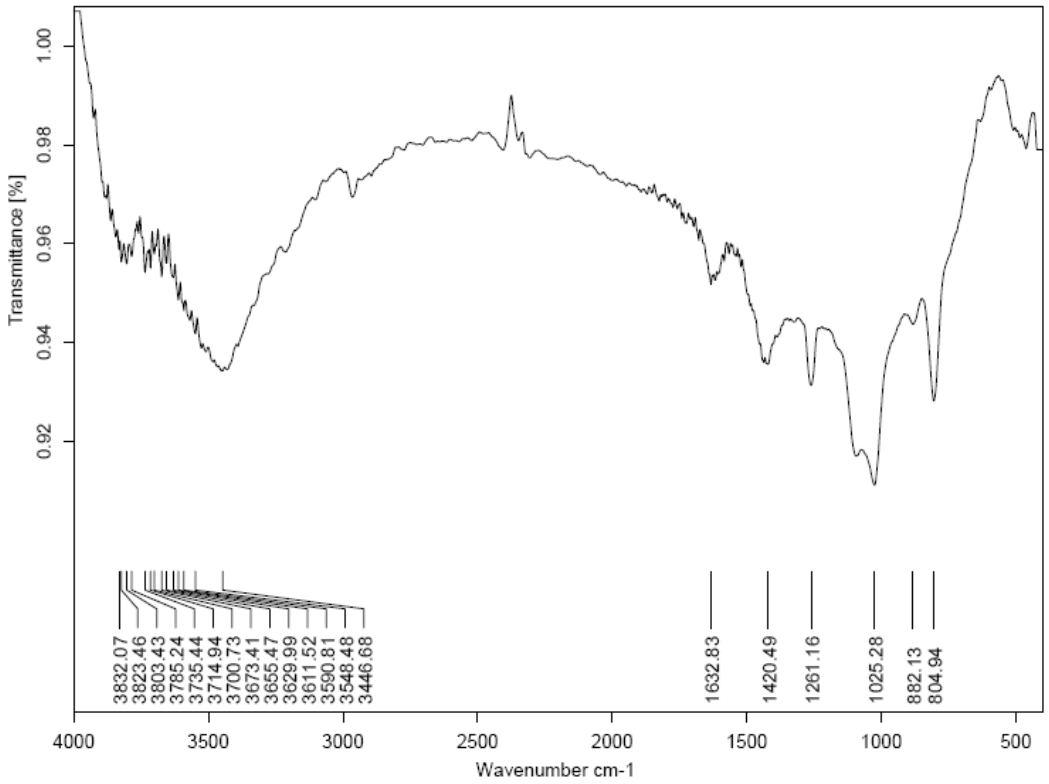
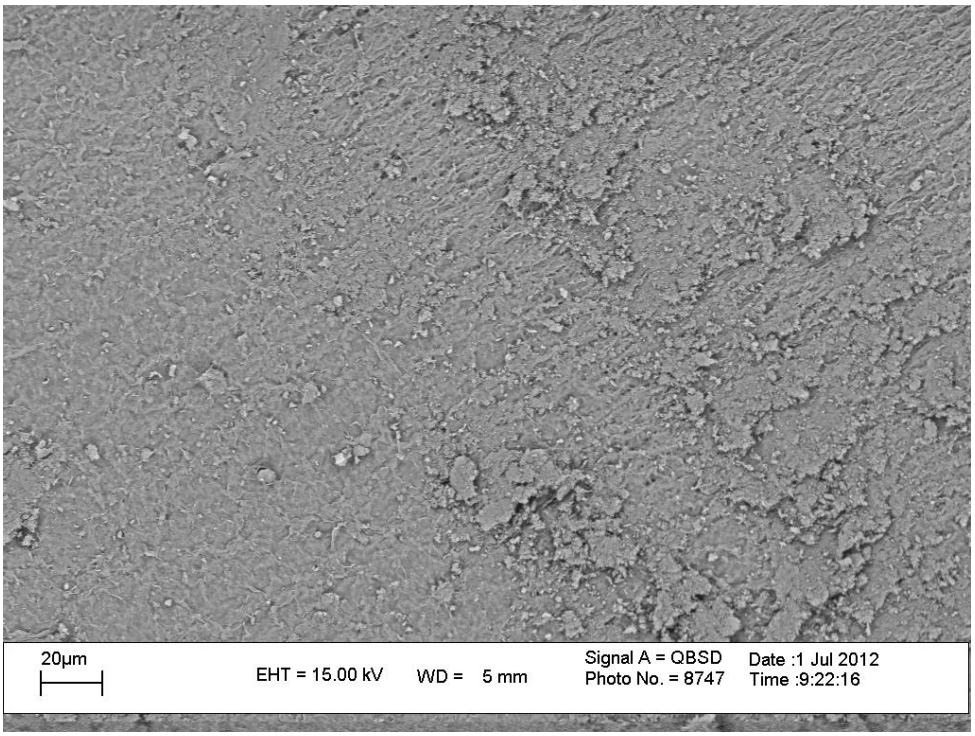


f

Fig. S2 IR spectra of the Amorphous manganese oxide-coated montmorillonite, clay (a), clay with manganese content of 3.0 wt % (b) and clay with manganese content of 5.0 % prepared at 100 (c), 300 (d), 400 (e) and 700 ^{o}C (f).



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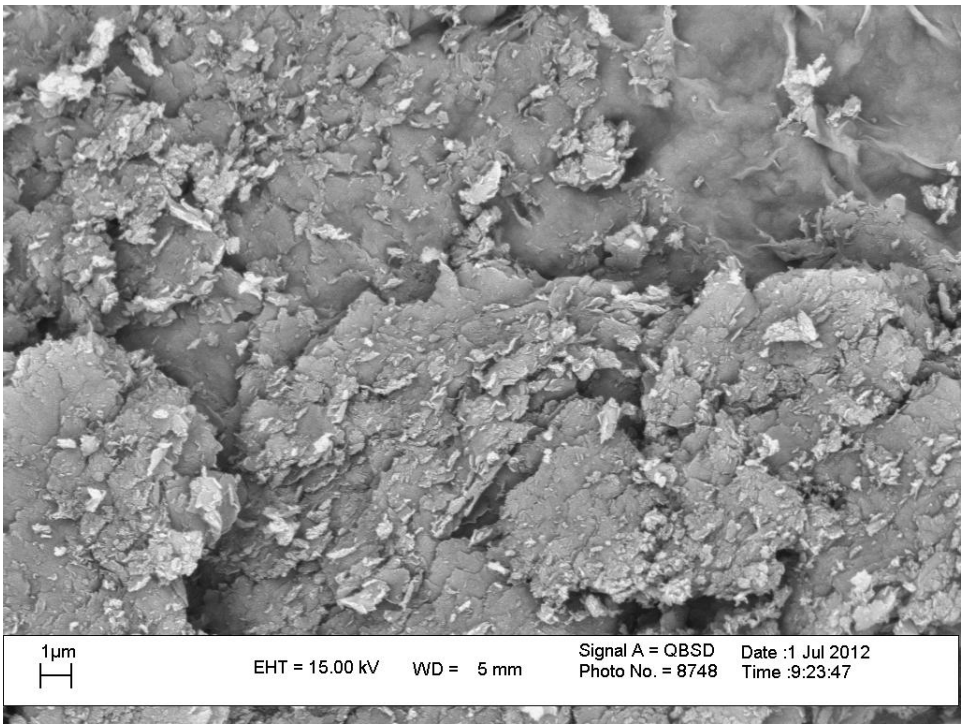

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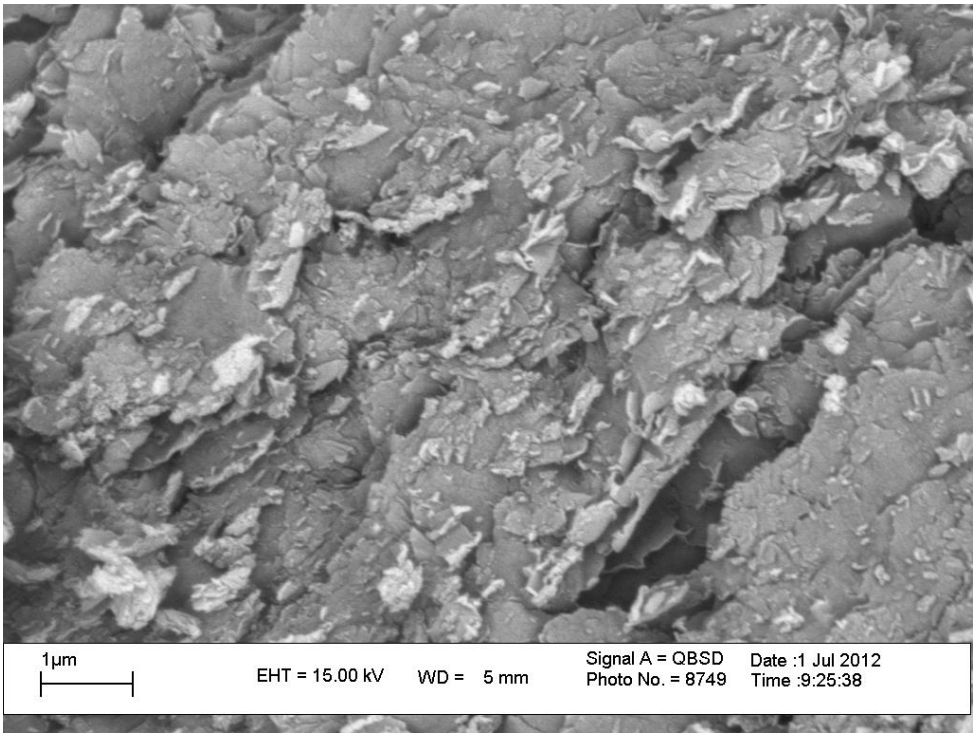

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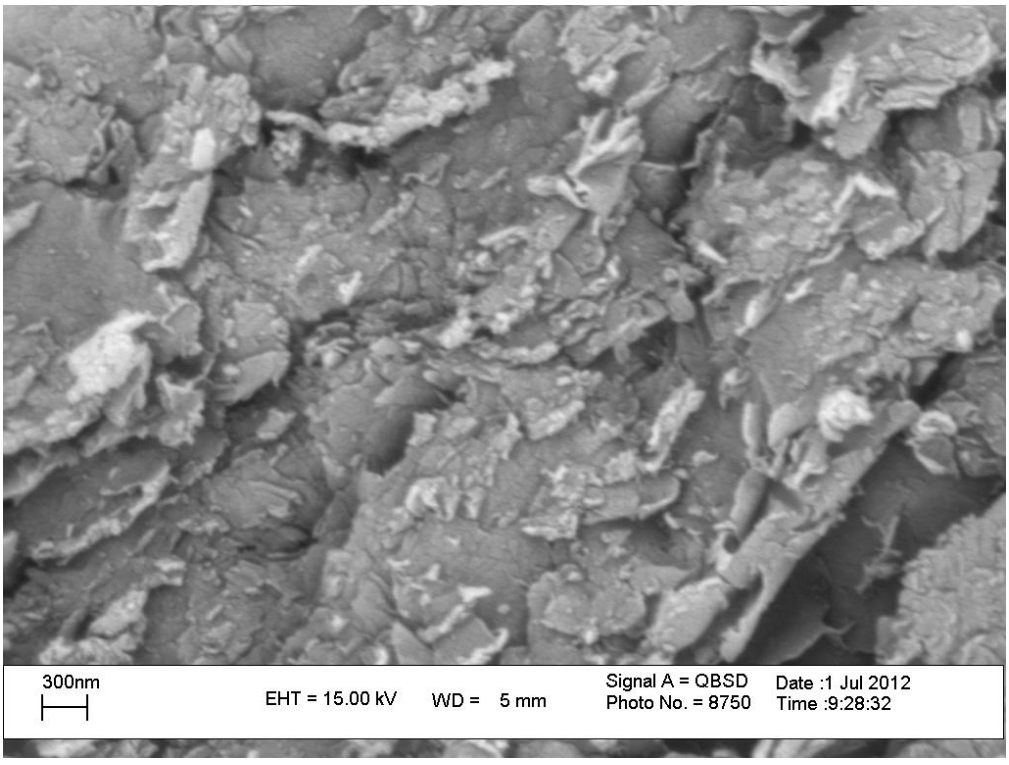
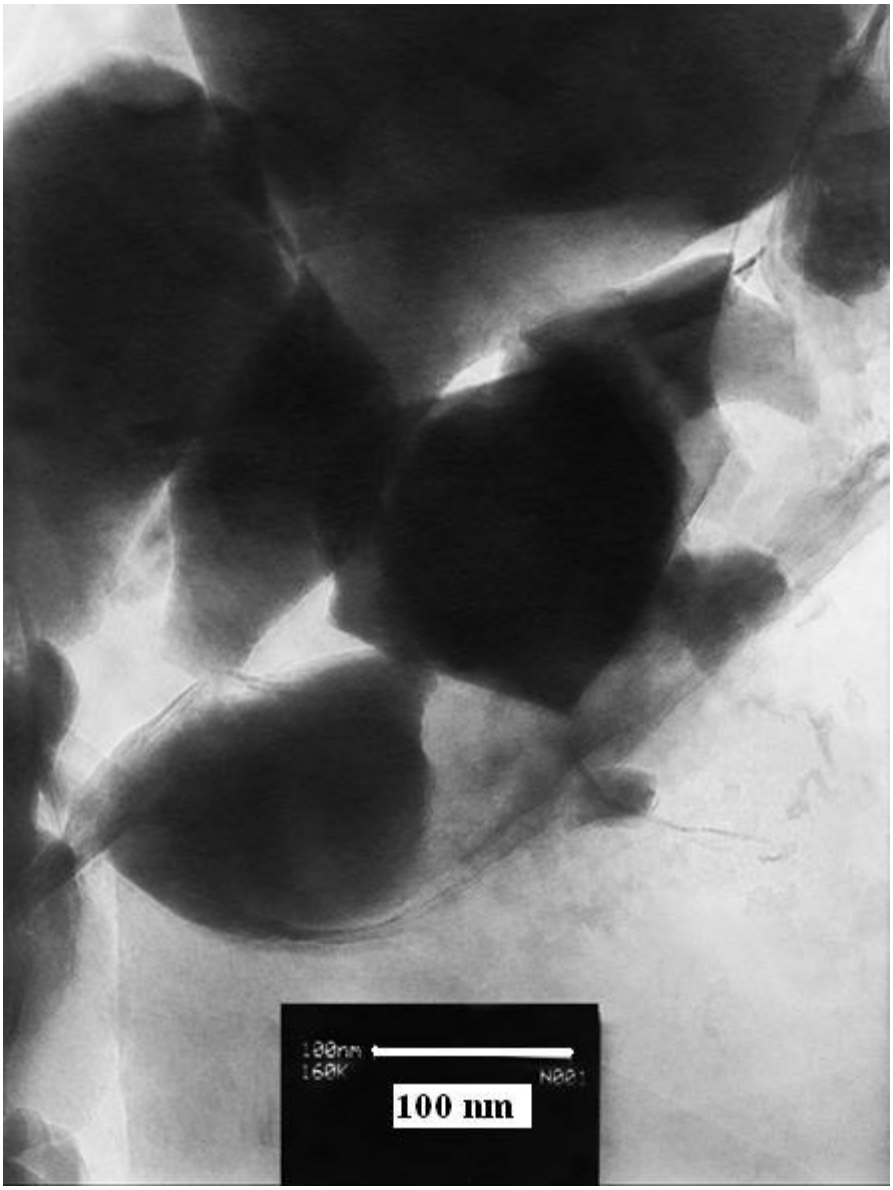


d

Fig. S3 SEM images of manganese oxides on clay with manganese content of 5.0 % (a-d).



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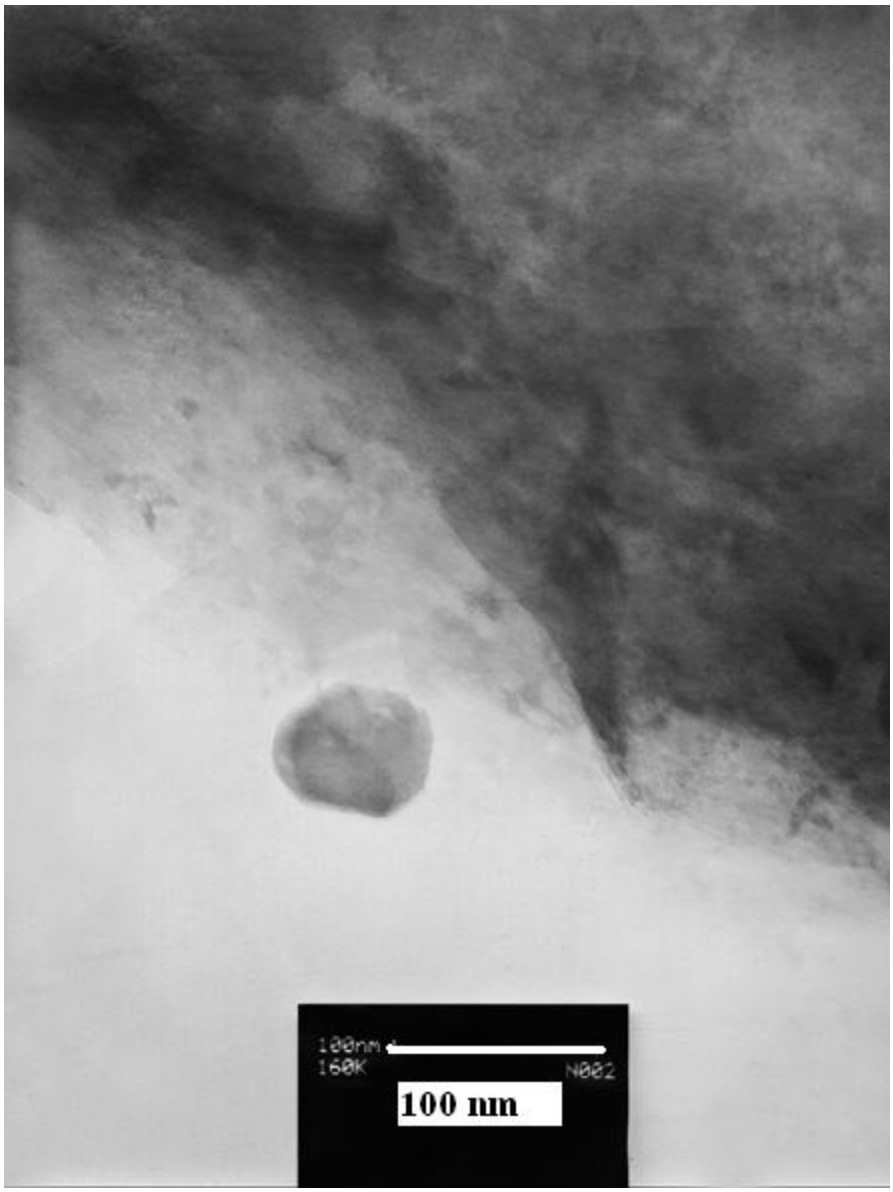

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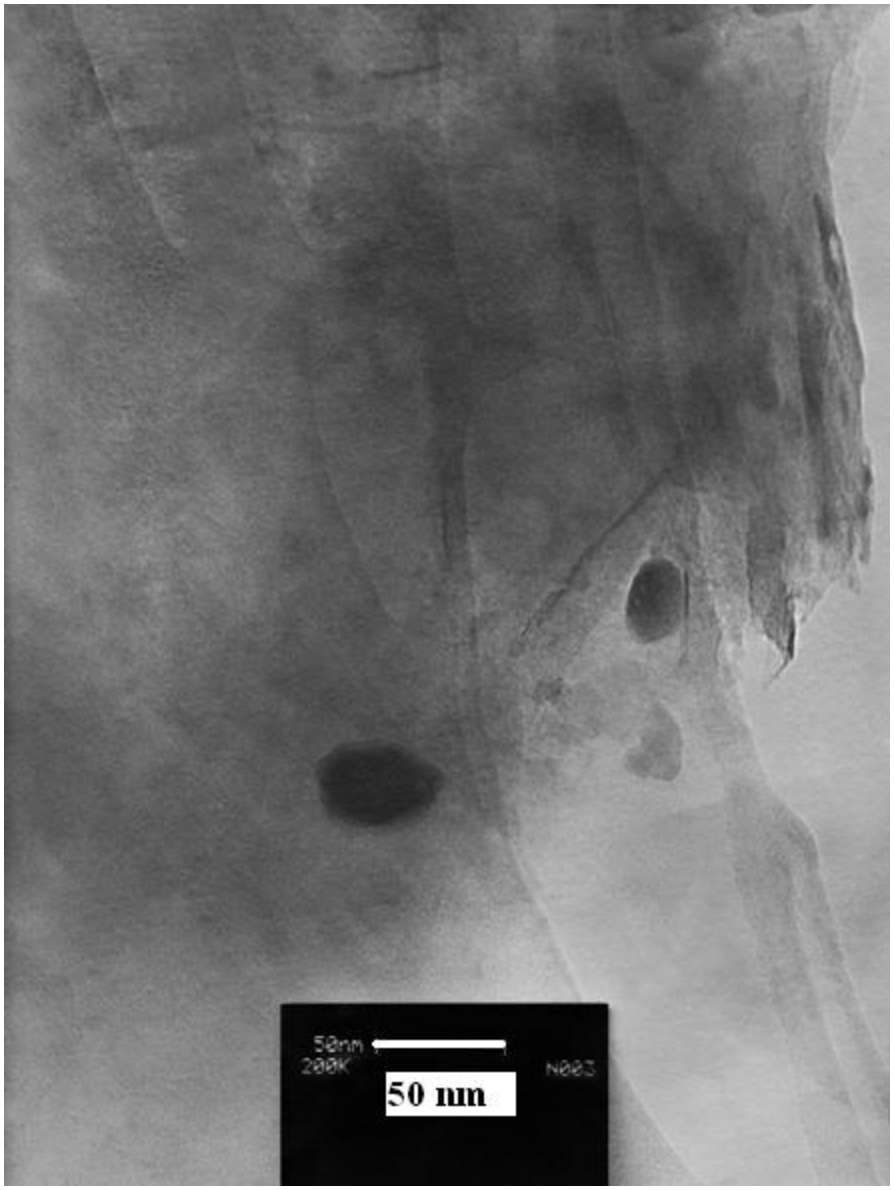

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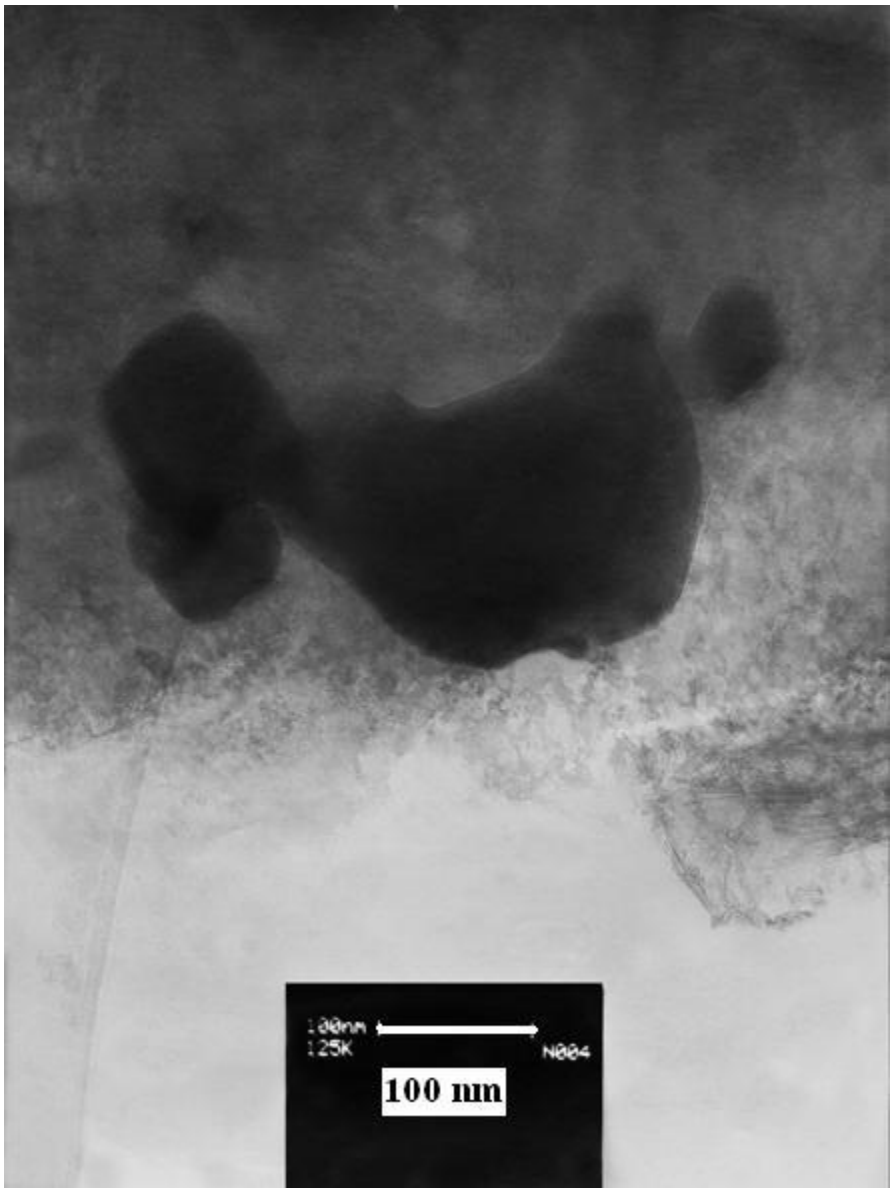

d

Fig. S4. TEM images of manganese oxides on clay with manganese content of manganese: 5% (a-d).

Table S1 The rate of water oxidation by the various manganese oxides as catalysts for water oxidation.

Compound	Oxidant	TOF[a]	References
Nano scale manganese oxide within NaY zeolite	Ce(IV)	2.62	1
Layered manganese-calcium oxide	Ce(IV)	2.2	2
Layered manganese-aluminium or zinc oxide	Ce(IV)	1.1	3
$CaMn_2O_4.H_2O$	Ce(IV)	0.54	4
Amorphous Manganese Oxides	$Ru(bpy)_3^{3+}$	0.06	5
	Ce(IV)	0.52	
$CaMn_2O_4.4H_2O$	Ce(IV)	0.32	4
Mn oxide nanoclusters	$Ru(bpy)_3^{3+}$	0.28	6
Manganese oxide-coated montmorillonite	Ce(IV)	0.22	This Work
Nano-sized α-Mn_2O_3	Ce(IV)	0.15	7
Octahedral Molecular Sieves	$Ru(bpy)_3^{3+}$	0.11	5
	Ce(IV)	0.05	
MnO_2 (colloid)	Ce(IV)	0.09	8
α-MnO_2 nanowires	$Ru(bpy)_3^{3+}$	0.059	9
$CaMn_3O_6$	Ce(IV)	0.046	10
$CaMn_4O_8$	Ce(IV)	0.035	10
α-MnO_2 nanotubes	$Ru(bpy)_3^{3+}$	0.035	9
Mn_2O_3	Ce(IV)	0.027	4
β-MnO_2 nanowires	$Ru(bpy)_3^{3+}$	0.02	9
$Ca_2Mn_3O_8$	Ce(IV)	0.016	11
$CaMnO_3$	Ce(IV)	0.012	11
Nano-sized λ-MnO_2	$Ru(bpy)_3^{3+}$	0.03	12
Bulk α-MnO_2	$Ru(bpy)_3^{3+}$	0.01	9
Mn Complexes	Ce(IV)	0.01-0.6	12-14
PSII	Sunlight	100-400 × 10^3	15

a: mmol O_2/ mol Mn

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