Supporting Information

Electrochemical Investigations of Double Perovskite M_2NiMnO_6 (Where M = Eu, Gd, Tb) for High-Performance Oxygen Evolution Reaction

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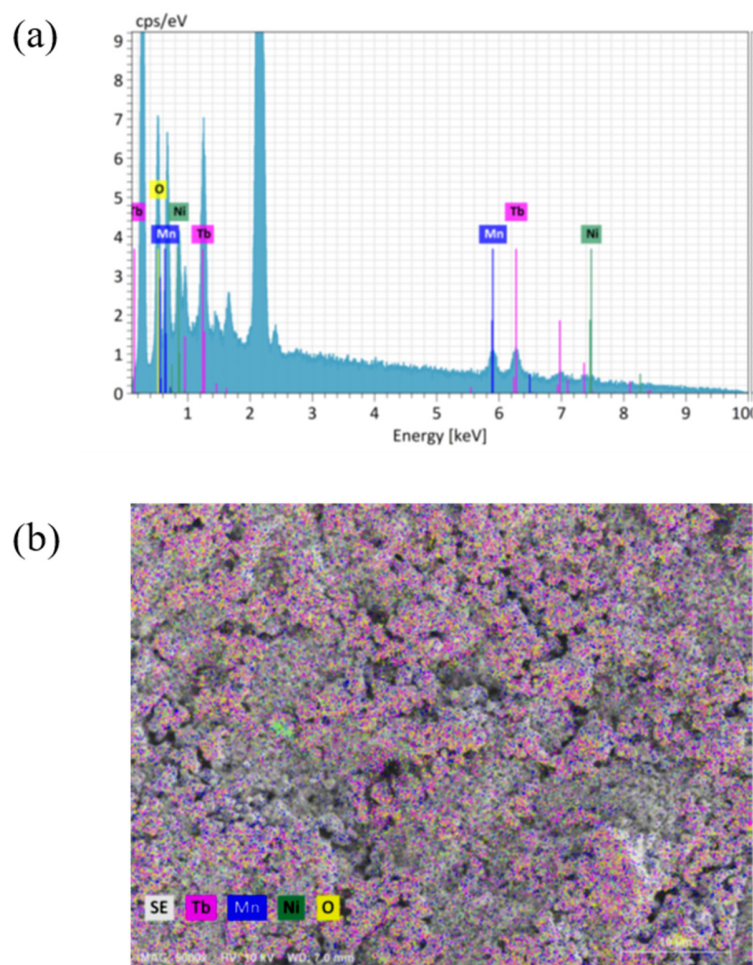* Correspondence: akbarphysics2002@gmail.com

Figure S1. (a) Energy dispersive X-ray analysis (EDAX) spectra of the double perovskite Tb$_2$NiMnO$_6$ catalyst electrode, indicating the presence of all the constituent elements in the catalyst. **(b)** Mixed elemental mapping image of the double perovskite Tb$_2$NiMnO$_6$ catalyst electrode.

Table S1. Structural parameters for M_2NiMnO_6 (where M= Eu, Gd, Tb) from the Rietveld refinement

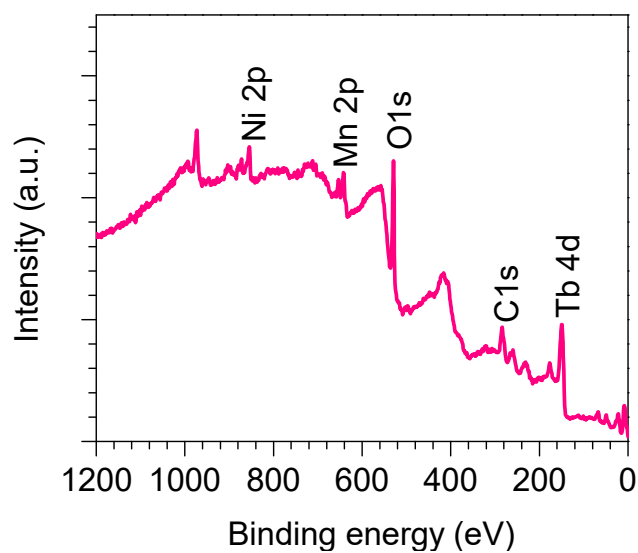| Cell parameters	Eu_2NiMnO_6	Gd_2NiMnO_6	Tb_2NiMnO_6
Space group	$P2_1/n$	$P2_1/n$	$P2_1/n$
Atomic number M2	63	64	65
Crystal density g/cm^3	7.65	7.86	7.98
Cell volume (Å^3)	222.9	221.6	219.6

Figure S2. XPS survey spectra of the double perovskite Tb_2NiMnO_6 catalyst electrode depicting Ni. Mn. Tb and O in the sample.
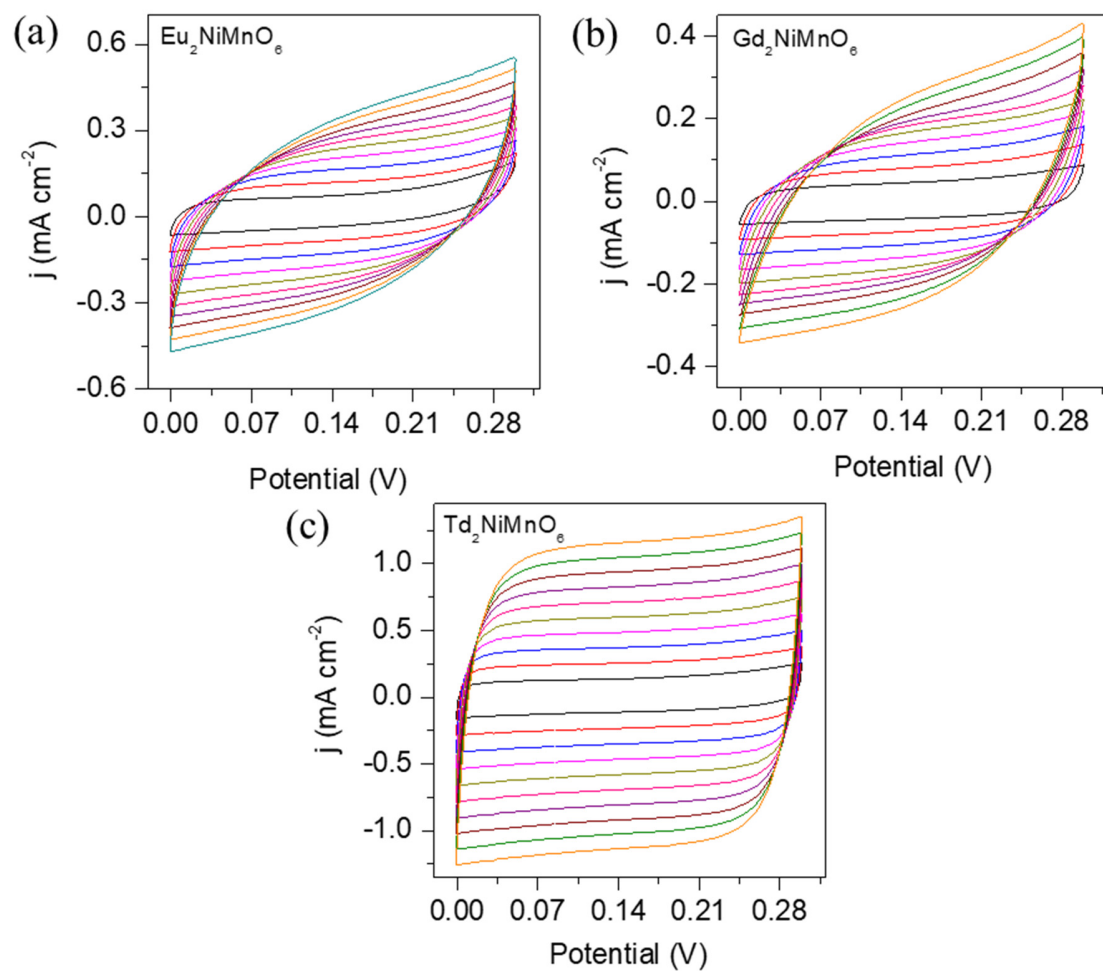
Figure S3. Cyclic voltammetry curves recorded at different scan rates of 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 mVs^{-1} in non-faradaic voltage region for **(a)** Eu_2NiMnO_6, **(b)** Gd_2NiMnO_6, **(c)** Tb_2NiMnO_6.

Table S2. Electrochemical water splitting parameters for OER analysis for the double perovskite M$_2$NiMnO$_6$ (M= Eu, Gd, Tb) compounds.

Sample name	Overpotential (mV) @ 10 mAcm^{-2}	Tafel slop (mV dec^{-1})	ECSA (cm^2)
Eu	334	52.3	159
Gd	292	45.11	55.5
Td	288	38.76	284

Table S3. Parameters determined from fitting of the electrochemical impedance spectroscopy (EIS) curves using equivalent circuit diagram.

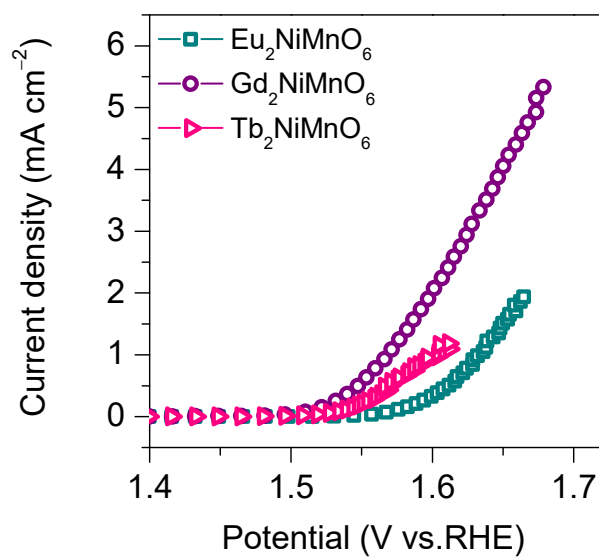| Sample name	EIS @ 0V		EIS @ 0.4 V	
	Rs (Ω)	Rct (Ω)	Rs (Ω)	Rct (Ω)
Eu	0.987	134.7	0.826	1.023
Gd	0.833	69.3	0.230	0.830
Td	0.984	16.9	1.034	0.698

Figure S4. The ECSA normalized LSV curves of the double perovskite M_2NiMnO_6 catalyst electrodes to know the intrinsic catalytic activity of the electrode.
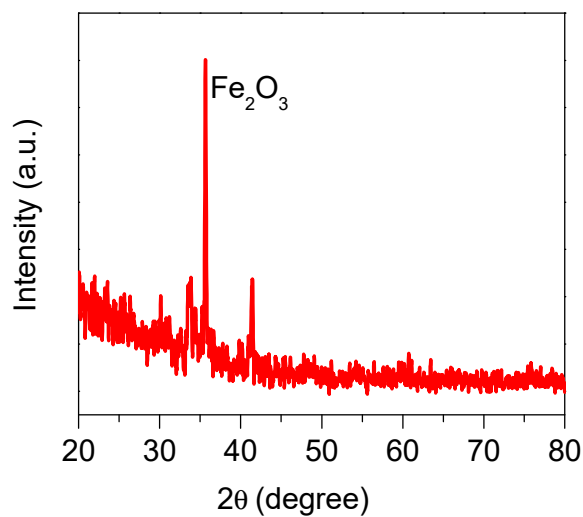

Figure S5. X-ray diffraction pattern of the Tb_2NiMnO_6 after long term OER test in alkaline electrolyte.

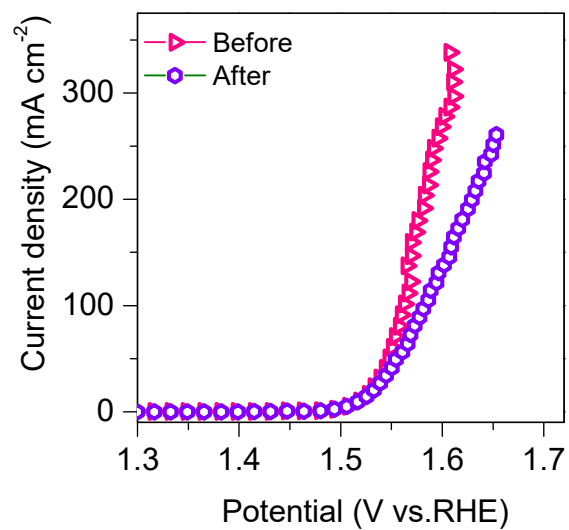**Figure S6.** The *iR*-corrected LSV curves of double perovskite Tb_2NiMnO_6 catalyst electrode before and after stability test of 100 hours confirm its excellent electrochemical stability.