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Electronic Supplementary Information

# Improvement of $O_2$ storage/release rate in $YMnO_3$ nanoparticles synthesized by polymerization-complex method

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**Experimental**

*Preparation of $YMnO_3$ nanoparticles by polymerization-complex method*

$(CH_3COO)_3Y \cdot 4H_2O$ (98%, FUJIFILM Wako Pure Chemical Co.) and $Mn(CO_3)_2 \cdot nH_2O$ (88% $Mn(CO_3)_2$, FUJIFILM Wako Pure Chemical Co.) (Y:Mo = 1:1) was added into 3.2 $mol \cdot L^{-1}$ citric acid (CA) aqueous solution, and stirred on a hot plate at 40 °C. After complete dissolution of the two reagents, 5.876 mL ethylene glycol (EG) was further added. In the solution, 0.064 mol CA and 0.105 mol EG were included. and heated with stirring at 150 °C until formation of transparent gel. The obtained gel was calcined to form a black powder. The obtained samples were denoted as YMO_XXX_YY where XXX and YY means calcination temperature and time, respectively. In addition, the ratio of CA and EG was altered for the gel formation. In this case, 5.4 $mol \cdot L^{-1}$ CA aqueous solution was used instead of 3.2 $mol \cdot L^{-1}$ CA aqueous solution. The obtained gel was calcined at 800 °C for 6 h. The obtained sample was denoted as YMO_CA_800_6.

*Characterization*

Powder XRD measurements were conducted on a Bruker D2 Phaser with Cu Kα (λ = 0.15418 nm). The transmission electron microscopy images were collected with a JEOL JEM2000EXII electron microscope.

*Evaluation of oxygen storage property*

TG-DTA machine (Rigaku Co., ThermoPlusEVO TG8120) was used for evaluation of oxygen storage property. Before the evaluation, the samples were heated from r.t. to 500 ºC, and subsequently cooled to r.t. under $N_2$ flow (100 $mL \cdot min^{-1}$) with a ramping/decreasing rate of 5 $ºC \cdot min^{-1}$ in the TG-DTA machine. After the pre-treatment, TG measurement was directly conducted for the treated samples under pure $O_2$ flow (100 $mL \cdot min^{-1}$) or atmospheric air (relative humidity 20 % at 25%) by heating from r.t. to 500 ºC and the subsequent cooling to r.t. with a ramping/decreasing rate of 1 or 5 $ºC \cdot min^{-1}$.

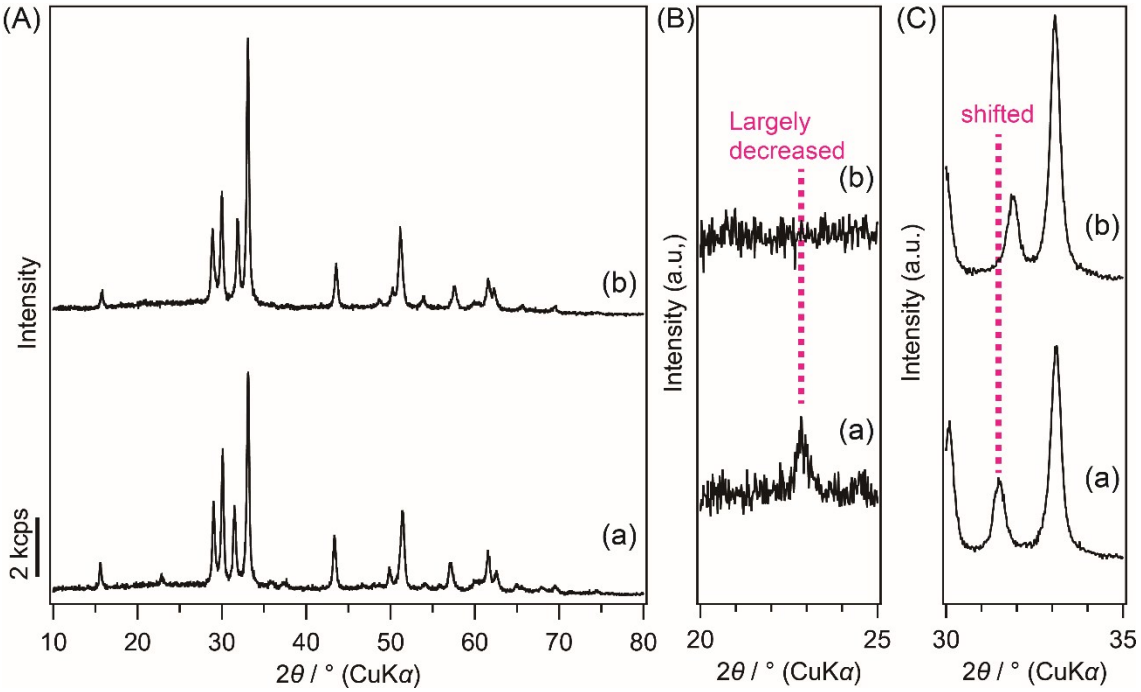


**Fig. S1** XRD patterns of YMO_800_6 (a) before and (b) after the TG measurement under pure $O_2$ flow with a $2\theta$ range of (A) 10-80°, (B) 20-25°, and (C) 30-35°.

After the TG measurement, the intensity of the peak at 23° was largely decreased, and the peak at 31.5° was shifted to higher angle region. The two behaviors with the retention of basic diffractions mean the appearance of the oxygen-adsorbed $YMnO_3$ phase (A. Klimkowicz *et al.*, *J. Solid State Chem.*, **258**, 471 (2018)).