Synthesis and Characterization of Copper Oxide-based Mesoporous Binary Metal Oxides

Bo Kyeong Jeon[1], Su Bin Park[1], Kyoung Ho Kim[1], Gwi Ok Park[1], and Ji Man Kim[1,*]
[1]*Department of Chemistry, Sungkyunkwan University, Suwon, Korea*

*E-mail: jimankim@skku.edu

Ordered mesoporous materials have been widely used as an excellent nanoscale-engineered materials for various applications due to their superior properties such as high specific surface area, large pore volume, uniform pore diameter and stability for recyclability.

In addition, transition metal oxides (TMOs), especially binary and ternary TMOs are promising materials for a range of potential applications in catalysis, chemical sensing, adsorption, separation, magnetic devices and energy conversion and storage; solar cells, lithium ion batteries, and supercapacitors due to their higher reversible capacity and better structural stability than single metal oxides [1].

Among transition metal oxides, copper oxide (CuO) is the one of the attracting materials owing to its abundance, low cost, nontoxicity, environmental friendliness, and chemical stability [2,3]. Moreover, it is generally used in purification of hydrogen production and known to have the high catalytic activity. However, it is well known that CuO generates by-products, and its high reaction temperature consumes large energy during the H_2 purification. To overcome these disadvantages, we adopted mesoporous CuO and TMOs with expecting synergistic effects. Therefore, we synthesized several ordered mesoporous binary transition metal oxides (BTMOs) based on CuO *via* nano-replication method.

In a hard templating method, the cubic *Ia*3*d* mesoporous silica KIT-6 was prepared to synthesize ordered mesoporous CuO and CuO-based mesoporous binary metal oxides. The prepared mesoporous transition metal oxides were synthesized via incipient wetness impregnation method, calcined in air and characterized by powder X-ray Diffraction (XRD), nitrogen adsorption-desorption isotherm analysis, and scanning electron microscopy (SEM).

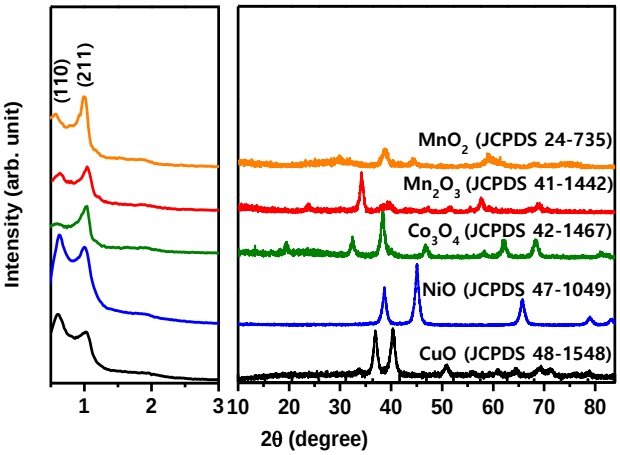

Fig. 1 The low angle and high angle powder X-ray diffraction (XRD) patterns of mesoporous single metal oxides (MO_x, M: Cu Ni, Co, Mn).

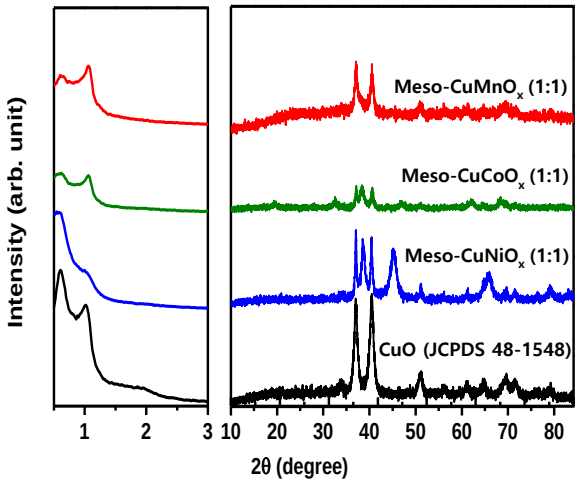

Fig. 2 The low angle and high angle powder X-ray diffraction (XRD) patterns of CuO-based mesoporous mixed metal oxides ($CuMO_x$, M: Ni, Co, Mn).

REFERENCES

[1] M.V. Reddy, G.V. SubbaRao and B.V. Chowdari, Chem. Rev., 113 (2013) 5364.
[2] J. Pal, C. Mondal, A.K. Sasmal, M. Ganguly, Y. Negishi and T. Pal, ACS Appl. Mater. Interfaces, 6 (2014) 9173.
[3] C. Wang, J. Xu, R. Ma and M.-F. Yuen, Mater. Chem. Phys., 148 (2014) 411.