

The current paper deals with the addition of transition metals (Fe,Co, Ni) to CuO-based MnO₂ nanowire catalysts for CO oxidation. The study uses various characterization techniques and catalytic activity measurements to identify the best catalyst for the reaction. While the authors identify that the addition of Co₃O₄ is most effective in lowering the temperature for the conversion of CO to CO₂, the underlying the reasons for the improvement in catalytic activity (oxygen vacancy formation energy) are not supported by the evidence presented from the characterization methods or the references cited. Moreover, it is not clear as to how the oxygen vacancy formation energy is relevant in the discussion of the overall reaction mechanism. I would recommend that the authors reconsider the writing in the discussion based on the comments below.

1. Page 2, Line 63: *"It was believed that the catalytic activity of MnO₂ was greatly related to the oxygen vacancy activity [29]."* The authors need to discuss the relation between catalytic activity and oxygen vacancy formation more explicitly.
2. Page 3, Line 105: *"2.1. Synthesis of α -MnO₂ Nanowire Supports."* Please include the source and purity of the chemicals used for the study.
3. Page 5, Line 203: *"Meanwhile, the intensity of diffraction peaks of CuO became sharp with the increase of the calcination 204 temperature."* This is not clear from Figure 1c. A sharp peak emerging at $\sim 38^\circ$ with increasing temperature is labelled as copper manganese oxide but the CuO peak at $\sim 40^\circ$ does not appear to grow. Please double check the XRD peak assignments.
4. Page 5, Line 211": *"(T = 200, 400, 500, 600)"*: Please include $^\circ\text{C}$ in the figure caption here and everywhere else where relevant.
5. Page 5, Line 219: *"The reason for 219 this was caused by the high loading contents of the CuO and transition metal oxides"* It is not clear as to why CuO and transition metal loading would lead to a decrease in the length to diameter ratio of the MnO₂ nanowires. The authors need to add an explanation for this.
6. Page 5, Line 225: *"As shown in Figure 2, the Cu and the doped Fe/Co/Ni elements were homogenously distributed over these investigated catalysts"*: The image for Cu EDS mapping in Figure 2 is not clearly seen. Please correct this.
7. Page 8, Line 280: *"The content of Mn³⁺ and oxygen vacancies was proportional, or indirectly proportional to the oxidation capacity of the catalyst [29]. The Mn³⁺ may cause the Jahn-Teller effect, which could prolong the Mn-O bond in [MnO₆] [47-48], thereby prolonging the distance between the oxygen pairs and causing the stretching of the Mn-O bond length. As a result, the Mn-O bond was easier to break and the mobility of oxygen became higher. Therefore, the released surface oxygen atoms were more likely to participate in the reaction, and thus promote the catalytic performance."* Here, the authors claim that the presence of Mn³⁺ can increase oxygen mobility, thereby increase catalytic activity. However, the authors also refer to [29], where the CO oxidation

activity was inversely proportional to the oxygen vacancy formation activity. There seems to be a contradiction here that the authors need to address.

8. Page 8, Line 292: *“It could be observed that the binding energy of surface lattice oxygen (Olatt) shifted to higher binding energy with the addition of transition metals.”* Please add the details of the peak position of the surface lattice oxygen to Table 2.
9. Page 9, Lines 309-327: It is not clear as to why the authors discuss the XPS spectra of the added transition metals (Fe 2p, Ni 2p, Co 2p). The authors need to add the relevance of the observations made in this section in the context of the CO oxidation reaction mechanism and reaction sites.
10. Table 3 is missing from the text. Please include this.
11. Page 10, Lines 369: *“As can be observed, the temperature of the 90% CO conversion over the 10CuO-3Co₃O₄/α-MnO₂-400 catalyst was 75 °C. The activity of 10CuO-3NiO/α-MnO₂-400 catalyst showed basically similar catalytic activity to that of the pristine 10CuO/α-MnO₂-400 catalyst without modification (T₉₀ = 77°C). However, the CO oxidation activity of the 10CuO-3Fe₂O₃/α-MnO₂-400 catalyst (T₉₀ = 80°C) was even worse than that of the pristine 10CuO/α-MnO₂-400 catalyst. Therefore, only the catalytic activity of the 10CuO-3Co₃O₄/α-MnO₂-400 was significantly improved compare with the pristine 10 CuO/α-MnO₂-400 catalyst.”* The authors claim improvement for the Co₃O₄ addition due to a decrease of 2 °C in T₉₀. The authors need to provide further evidence to show that the temperature difference is significant enough to support the claim and not that this different is within measurement error.
12. Page 10, Lines 377: *“From the order 377 of catalyst activity, it can be seen that the catalytic activity of the catalyst increases with the content of Mn³⁺ increases. Meanwhile, the loading of Co₃O₄ increased the specific surface area and pore volume of the catalyst, providing more active sites for the reaction”.* The two reasons for improvement suggested here need to be clearly differentiated. The role of Mn³⁺ needs to be evaluated after calculating the surface area normalized the reaction rates from BET. Only then can both the effects be discussed.
13. Page 10, Lines 377: *“The ratio of Oads/Olatt was not exactly the same as the catalytic activity of the catalyst, indicated that the amount of adsorbed oxygen was not the decisive factor affecting the catalytic activity.”* This result is rather surprising, and the authors need to discuss this further especially that in Line 284 the authors mention, *“As a result, the Mn-O bond was easier to break and the mobility of oxygen became higher. Therefore, the released surface oxygen atoms were more likely to participate in the reaction, and thus promote the catalytic performance.”*, implying that the surface oxygen should be correlated to Mn³⁺ and be beneficial for the reaction.
14. Page 11, Lines 392: *“The 10CuO-3Co₃O₄/α-392 MnO₂-400 catalyst performed the highest activity in the low temperature region. The reason for this might be due to the increased Co₃O₄ load amount, resulting in the reduced CuO dispersion on the α-MnO₂*

support.” The authors need to add why reduced CuO dispersion would lead to improved activity at low temperature.

15. Page 12, Line 445: *“It was found that the 10CuO-3Co₃O₄/α-MnO₂-400 catalysts possessed the largest specific surface area and most abundant oxygen vacancies, which could facilitate the rapid conversion of oxygen species and further enhance the catalytic activity.”* The authors need to clearly mention about they arrive at the oxygen vacancy conclusion as they have not measured oxygen vacancy concentration.
16. The authors need to add a discussion section to explain why Co₃O₄ addition is most beneficial for CO oxidation by including the surface area normalized reaction rates, the relevance of Mn³⁺, surface oxygen species, oxygen vacancies in the context of the overall reaction mechanism/steps and compare it to the Ref [29] mentioned in the text.