

# Supplementary Information

## Transforming Carbon Dioxide into Jet Fuel using an Organic Combustion-Synthesized Fe-Mn-K Catalyst

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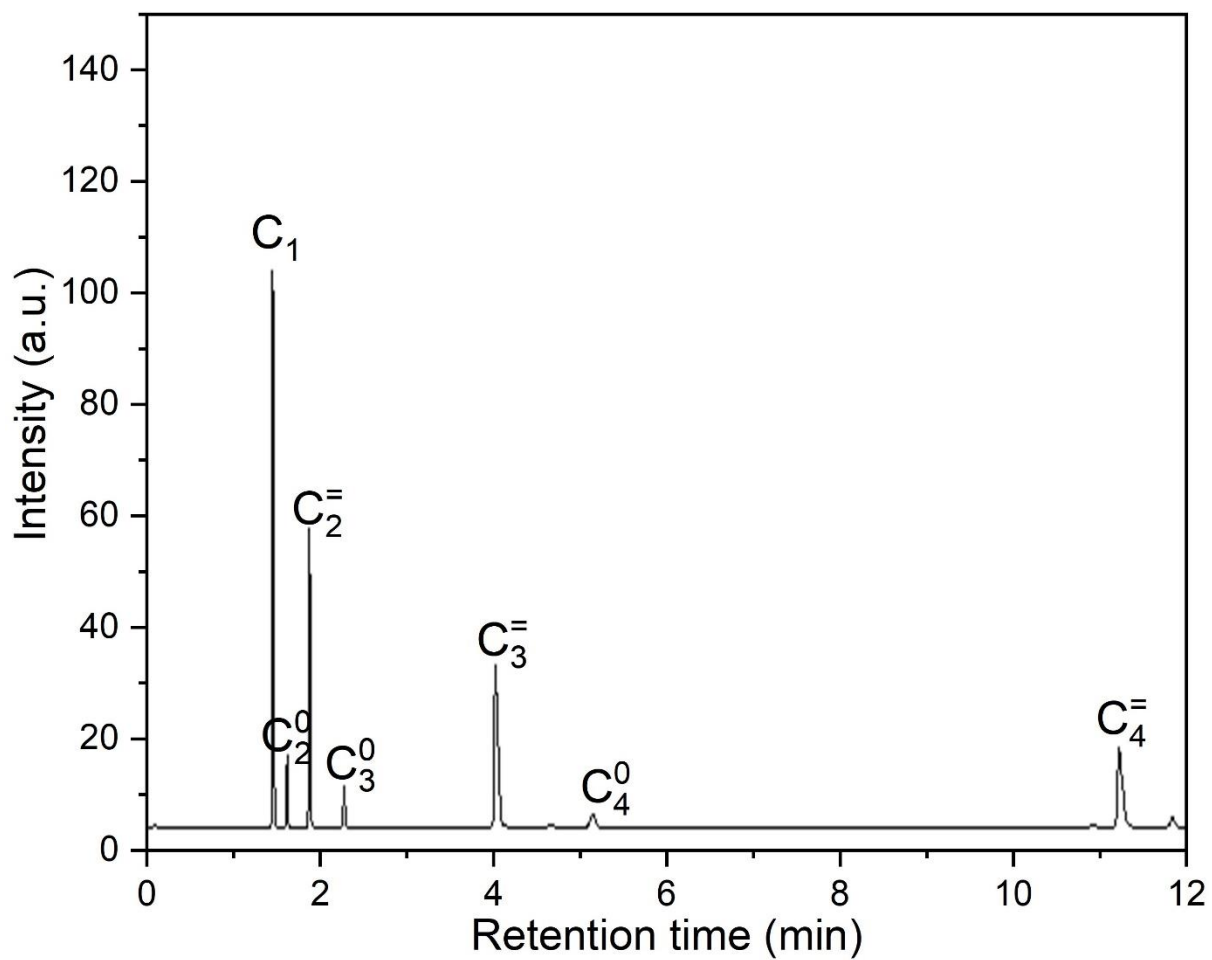
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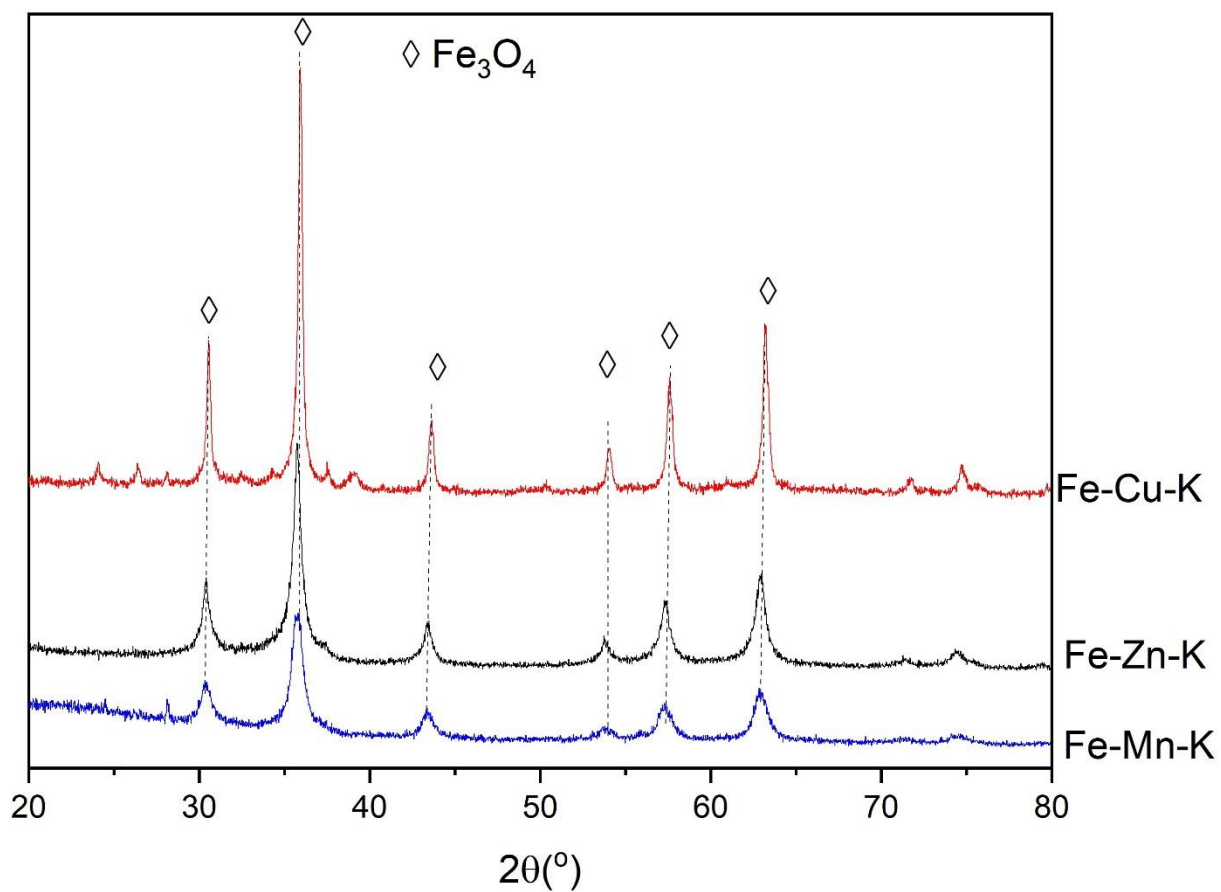
Corresponding author:

Dr. Tiancun Xiao, E-mail: xiao.tiancun@chem.ox.ac.uk; ORCID: 0000-0002-2278-3363

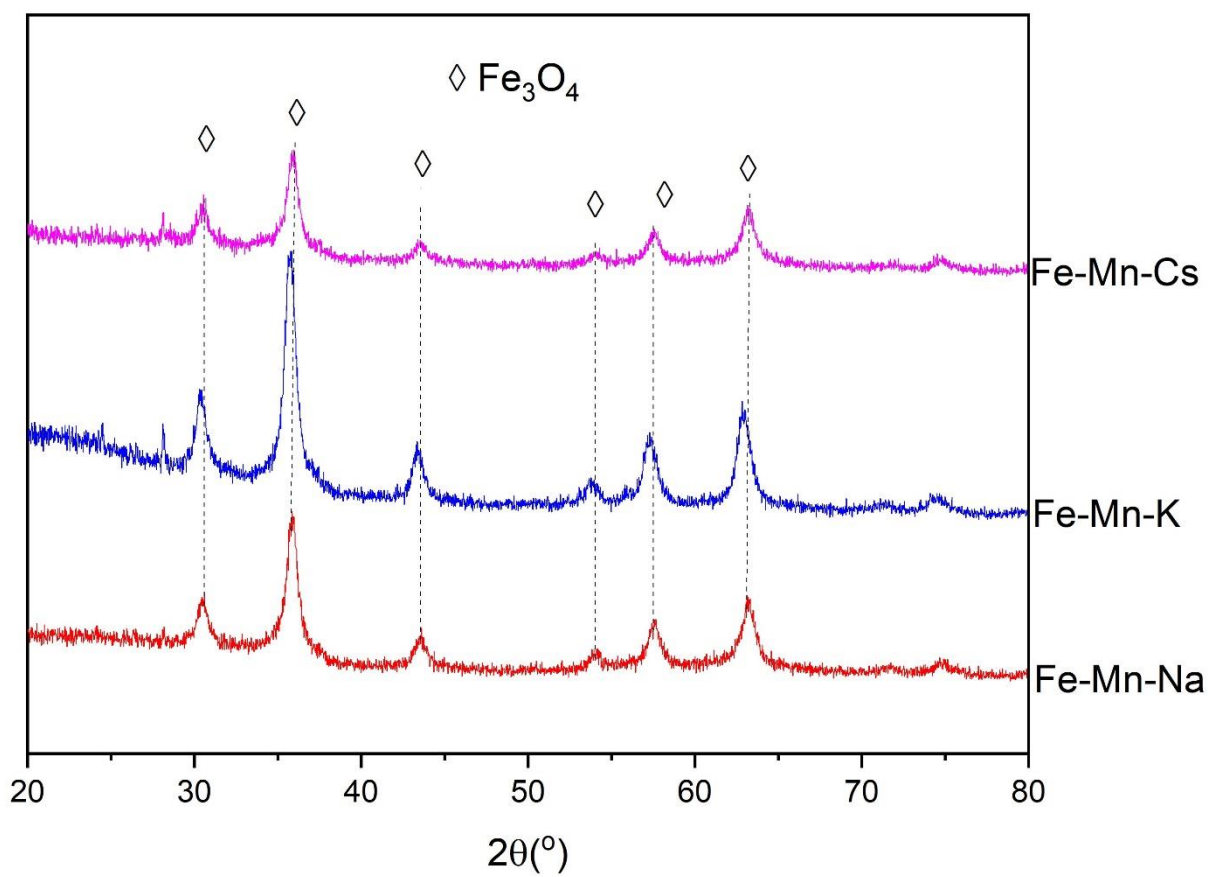
Professor Peter P. Edwards, E-mail: peter.edwards@chem.ox.ac.uk; ORCID: 0000-0002-1379-9400



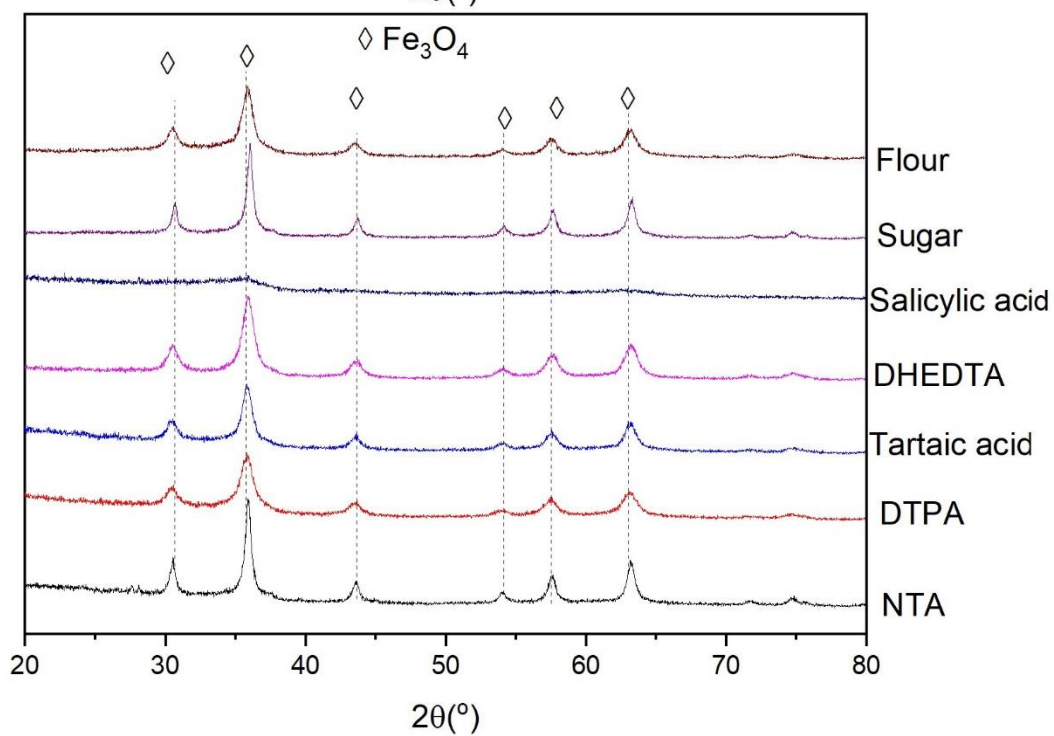
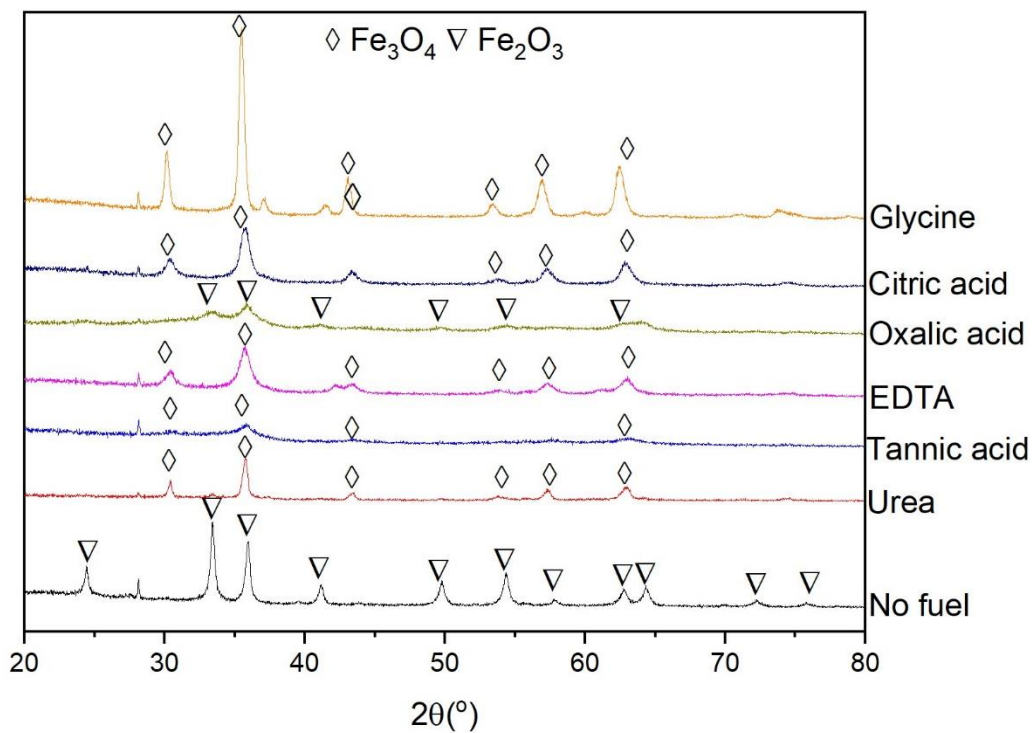
Supplementary Figure 1 GC-FID chromatograms of the gaseous hydrocarbon products from the hydrogenation of  $CO_2$ , taken at a reaction time of 20 hours.



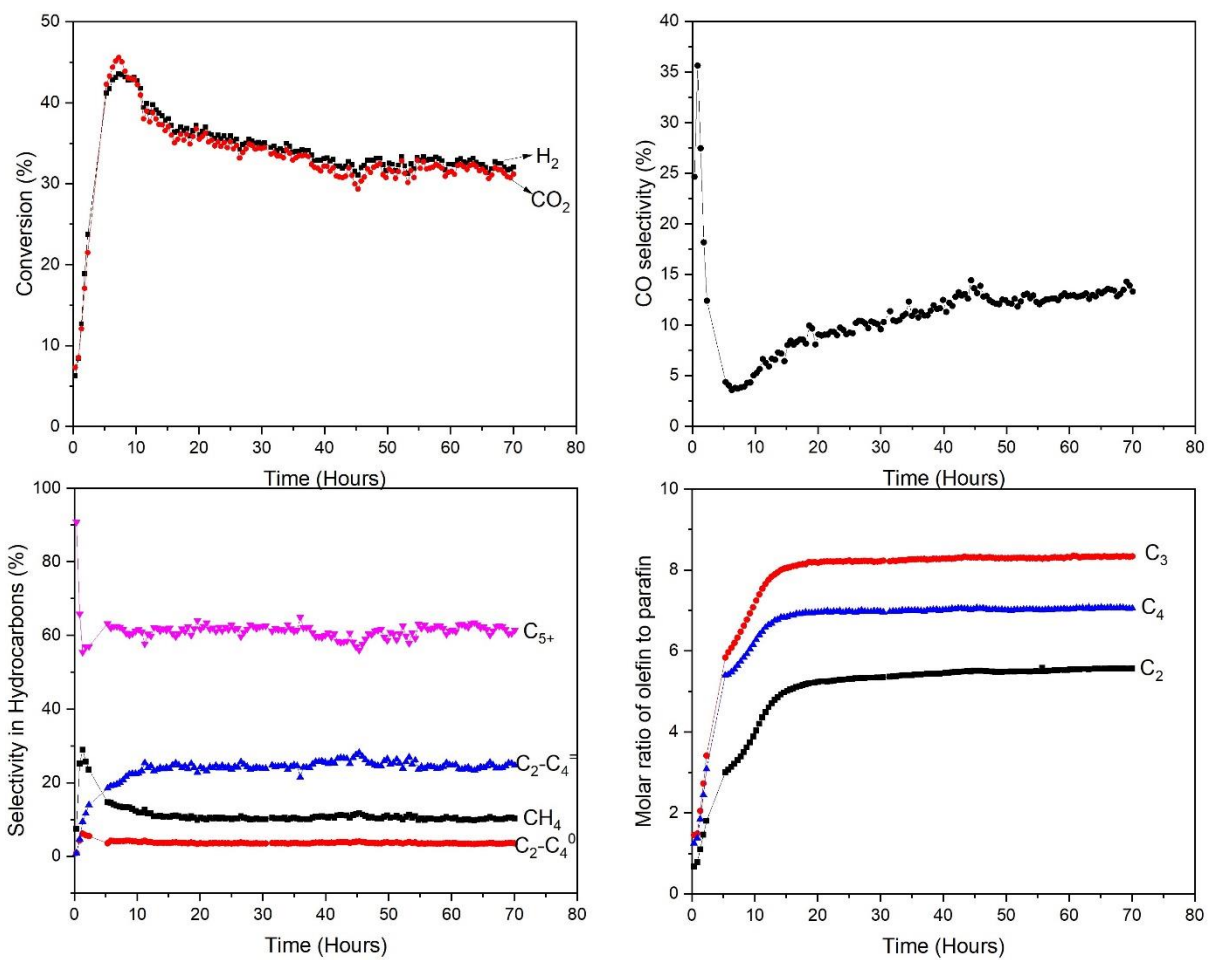
Supplementary Figure 2 XRD spectrum of catalysts (different transit metal) prepared with citric acid method



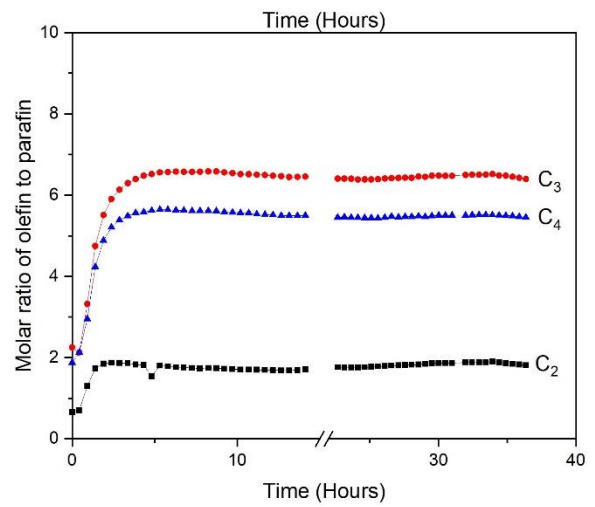
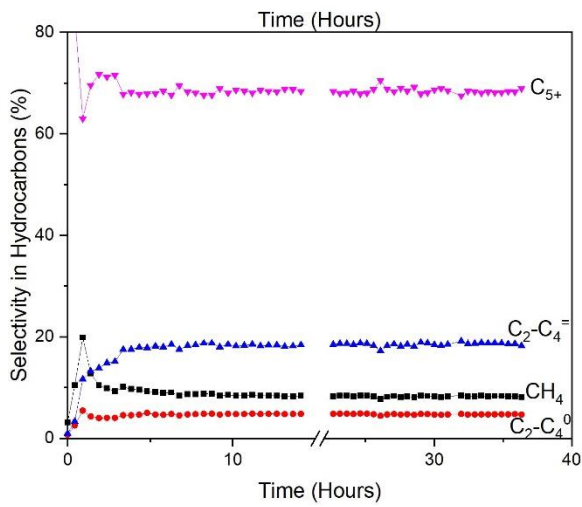
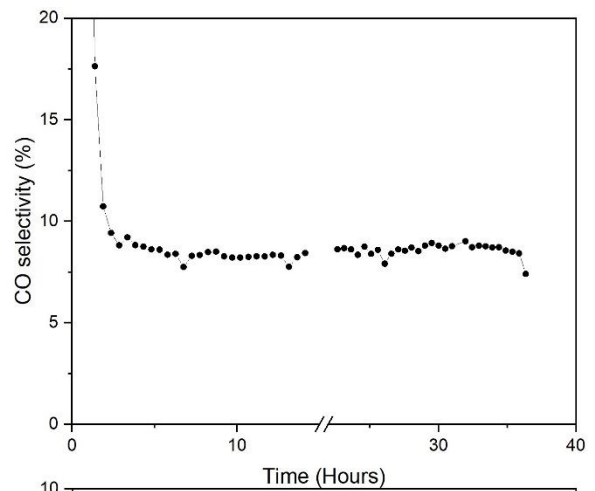
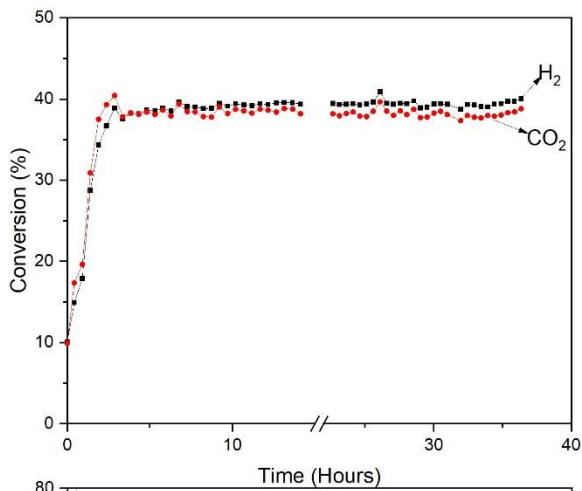
**Supplementary Figure 3 XRD spectrum of the catalysts (different base metal) prepared with citric acid method**



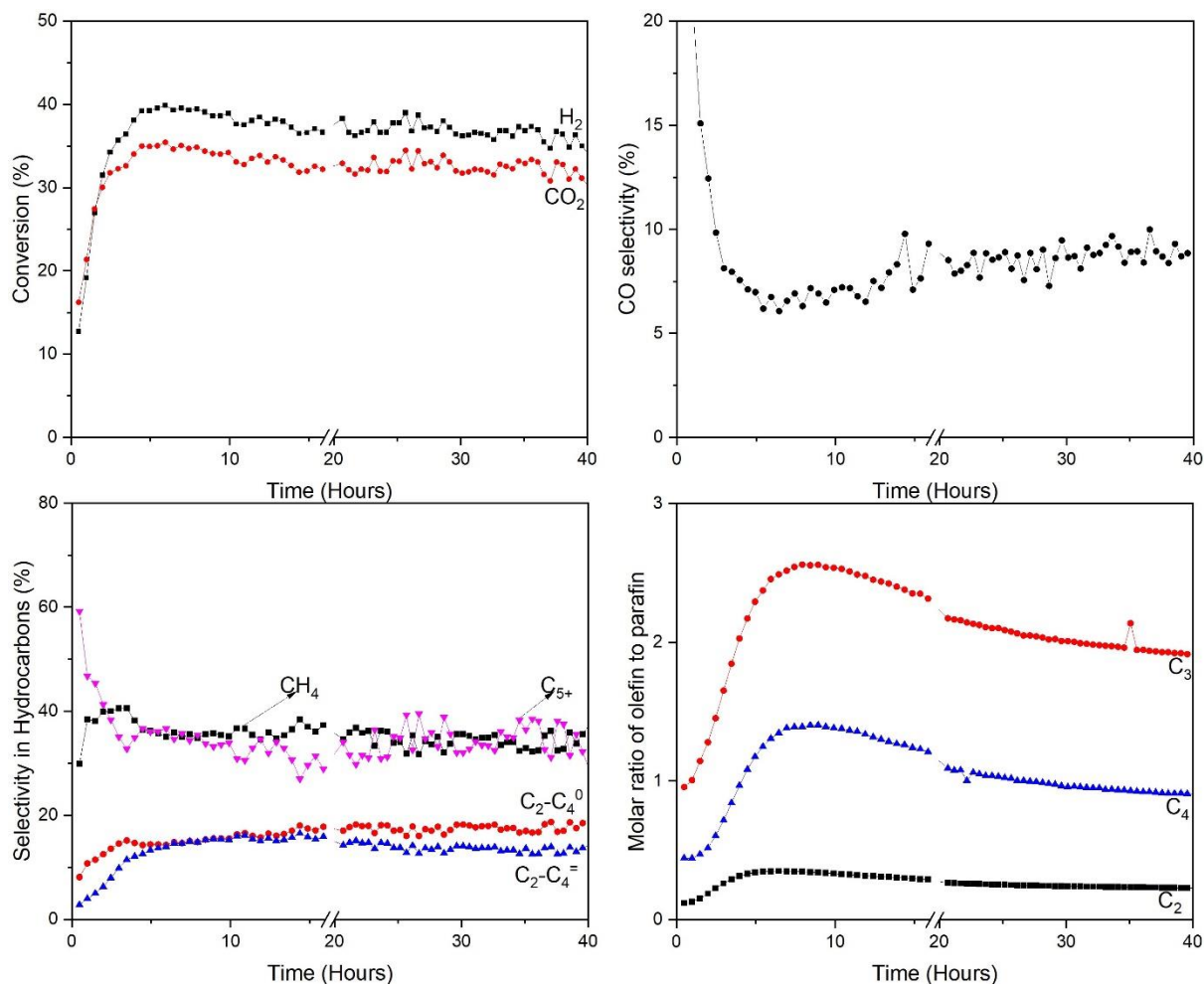
Supplementary Figure 4 XRD spectrum of the catalysts prepared with different organic compounds



**Supplementary Figure 5 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Zn- K**

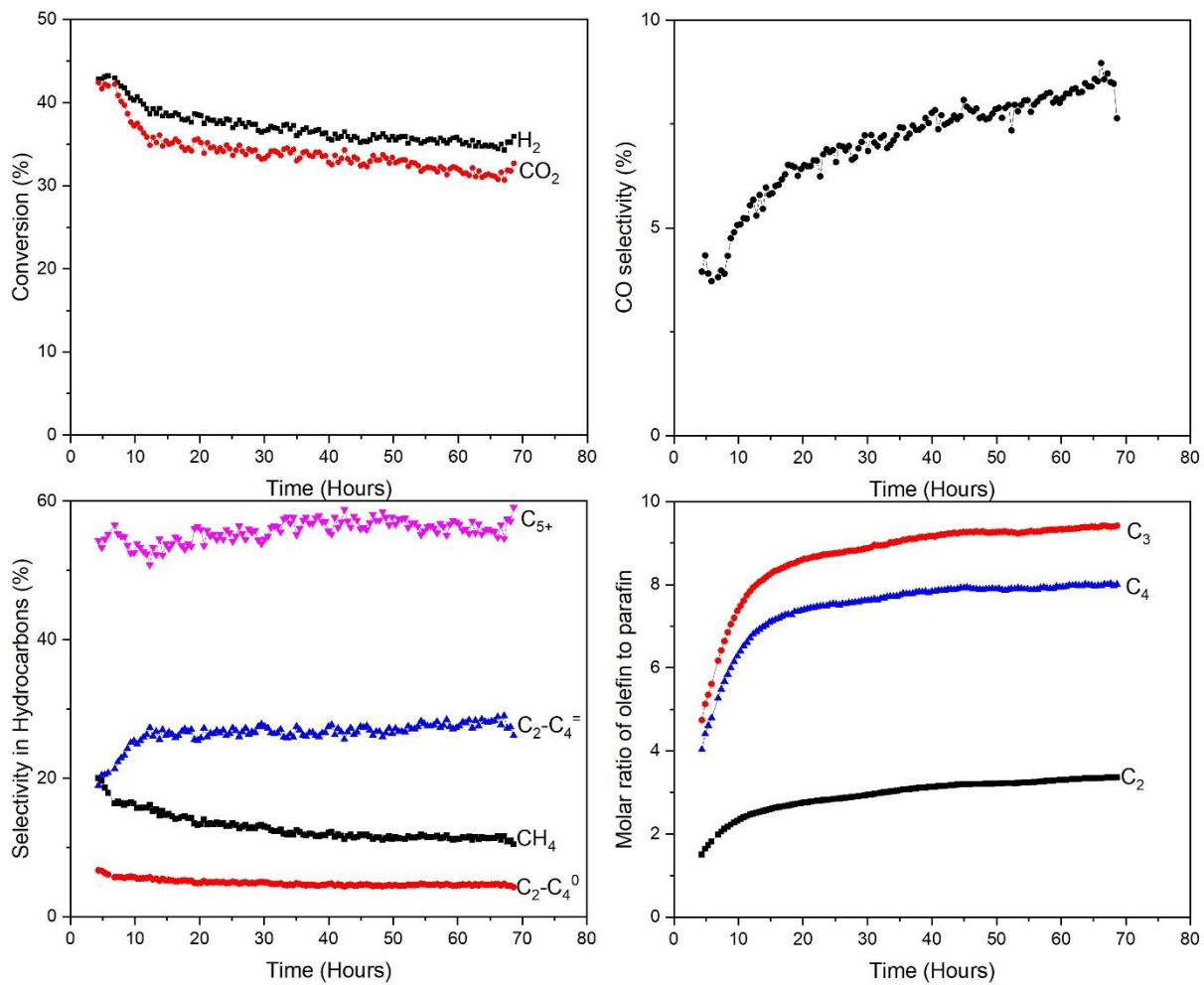


Supplementary Figure 6 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Cu- K

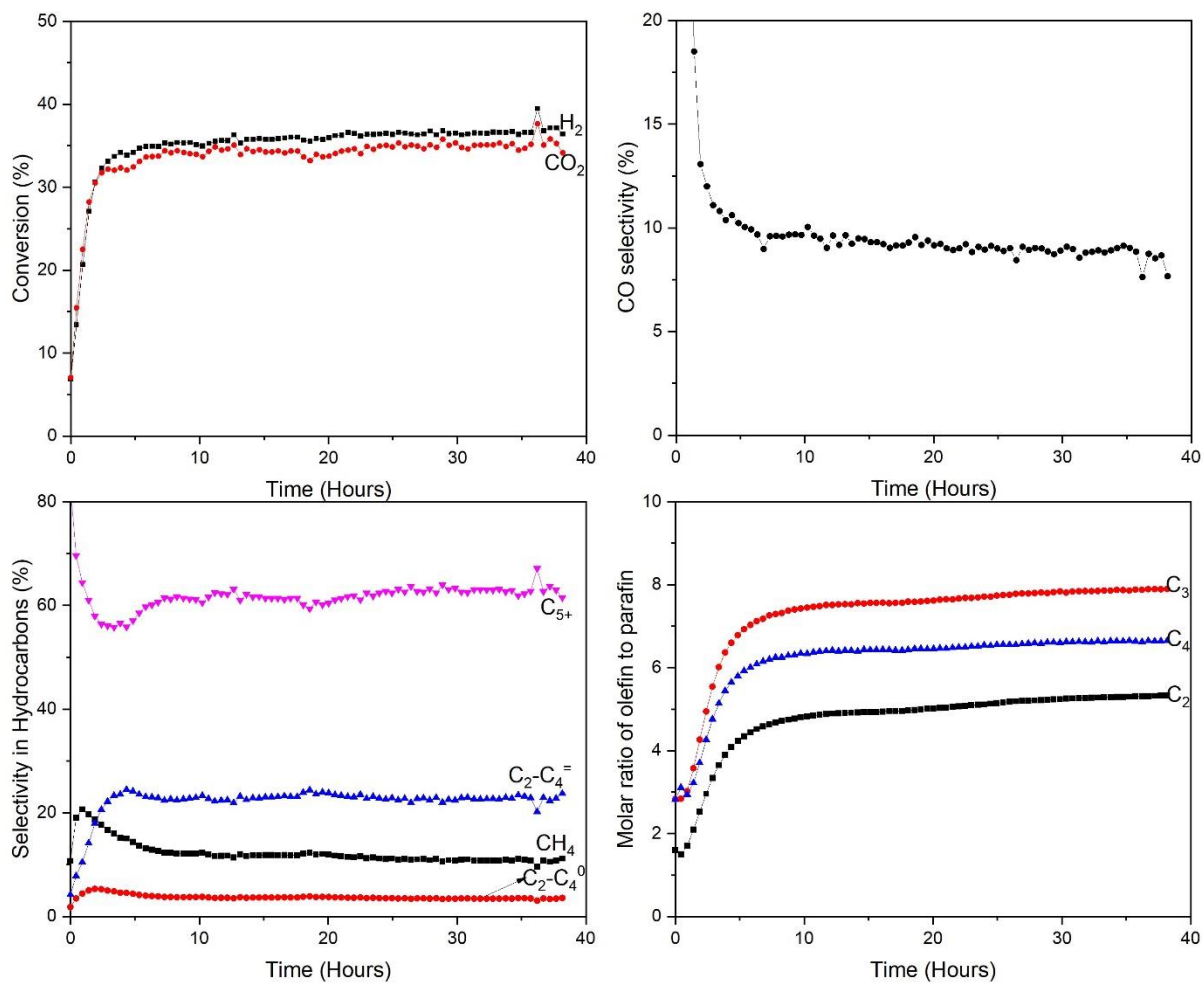


**Supplementary Figure 7 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Mn-Li**

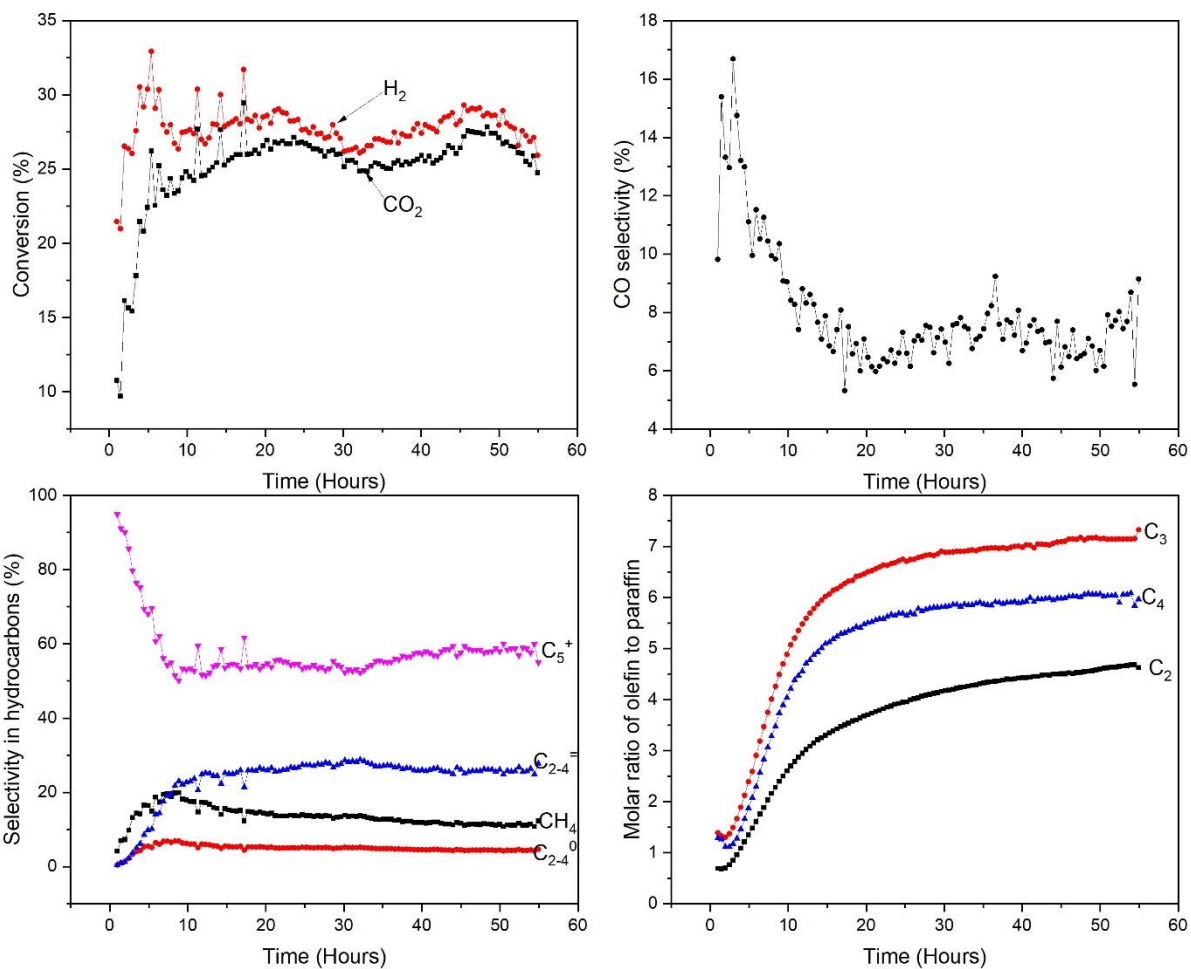




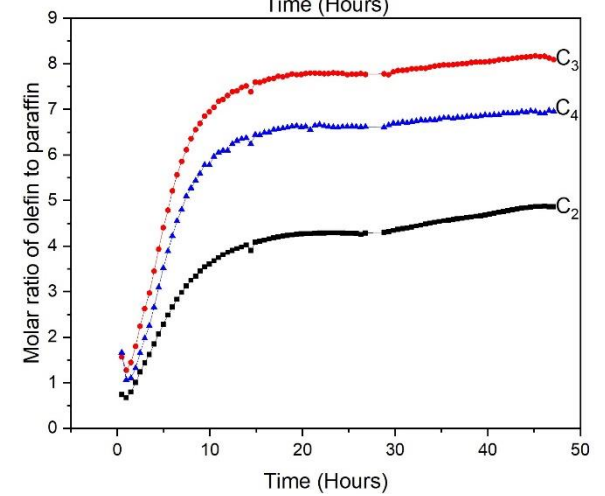
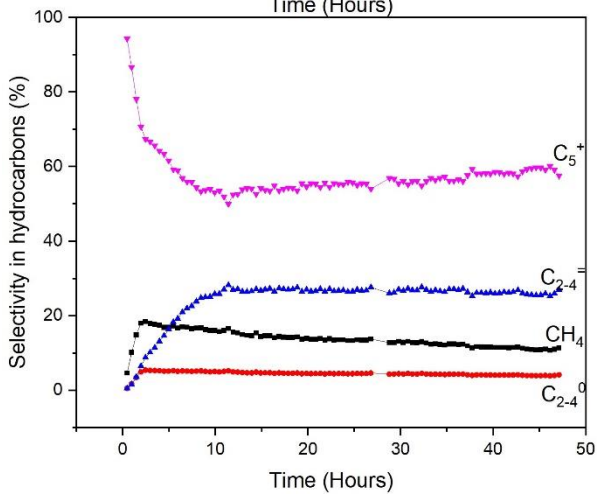
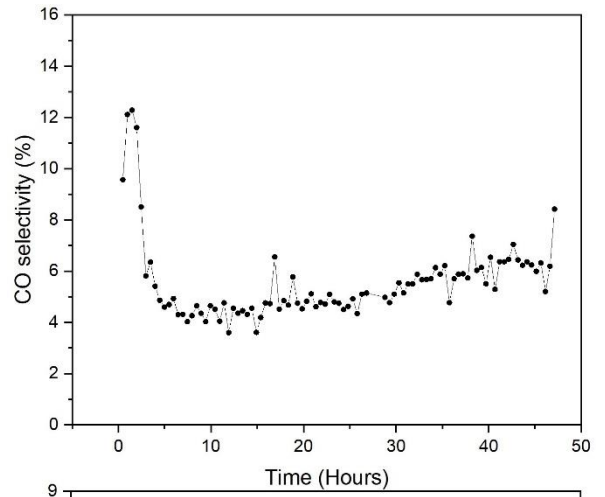
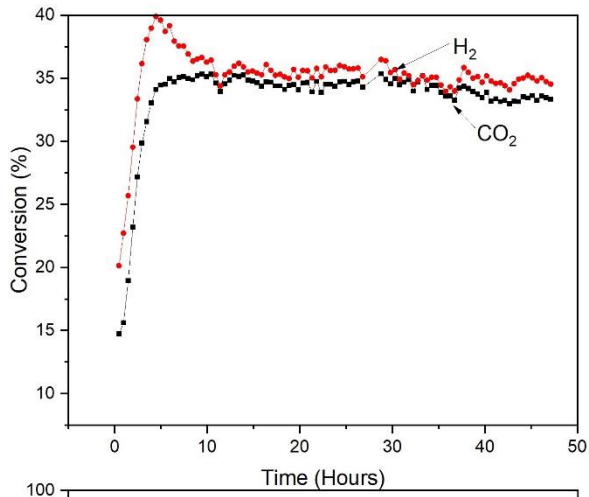
**Supplementary Figure 8 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn-Na**



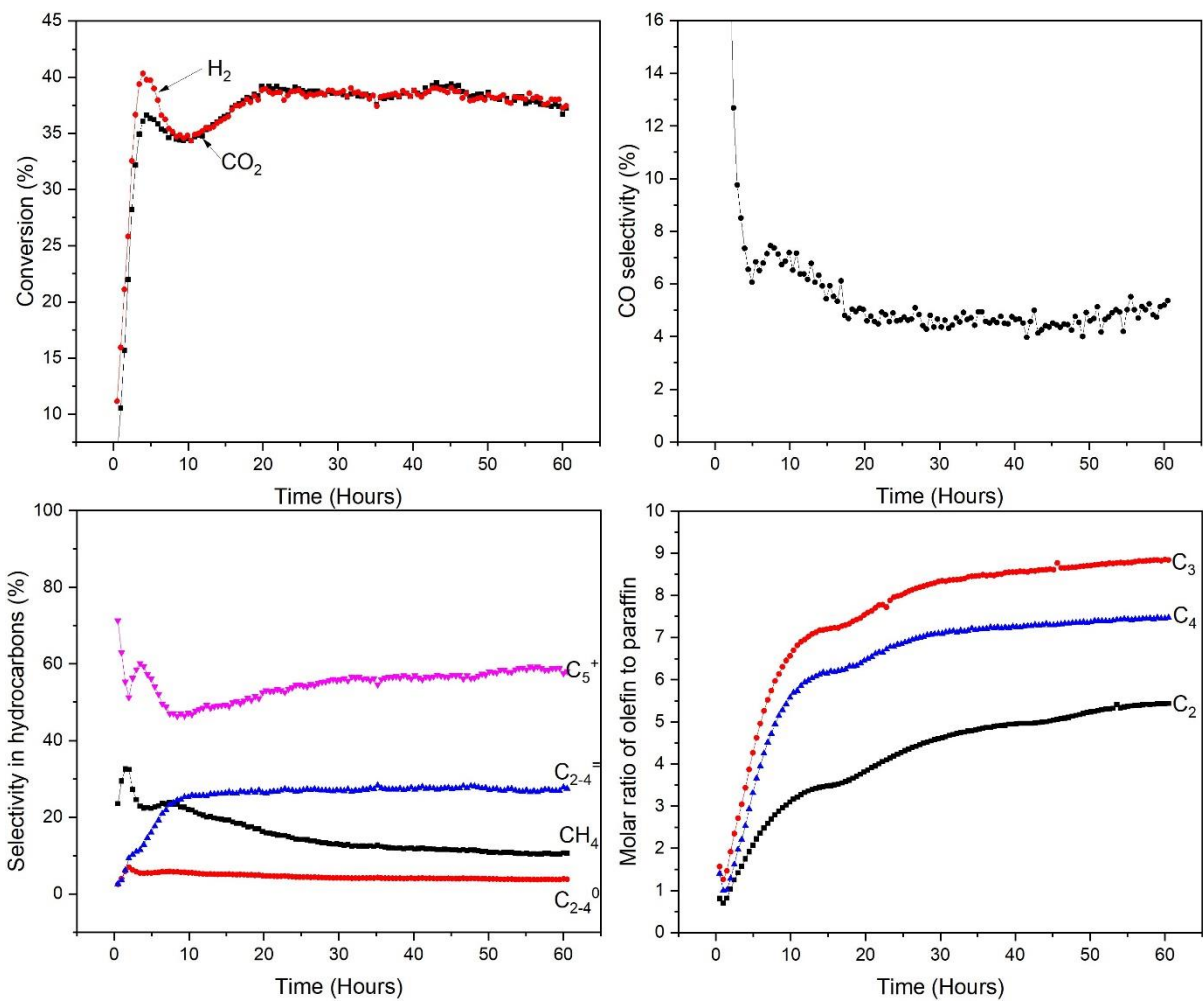
Supplementary Figure 9 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Mn-Cs



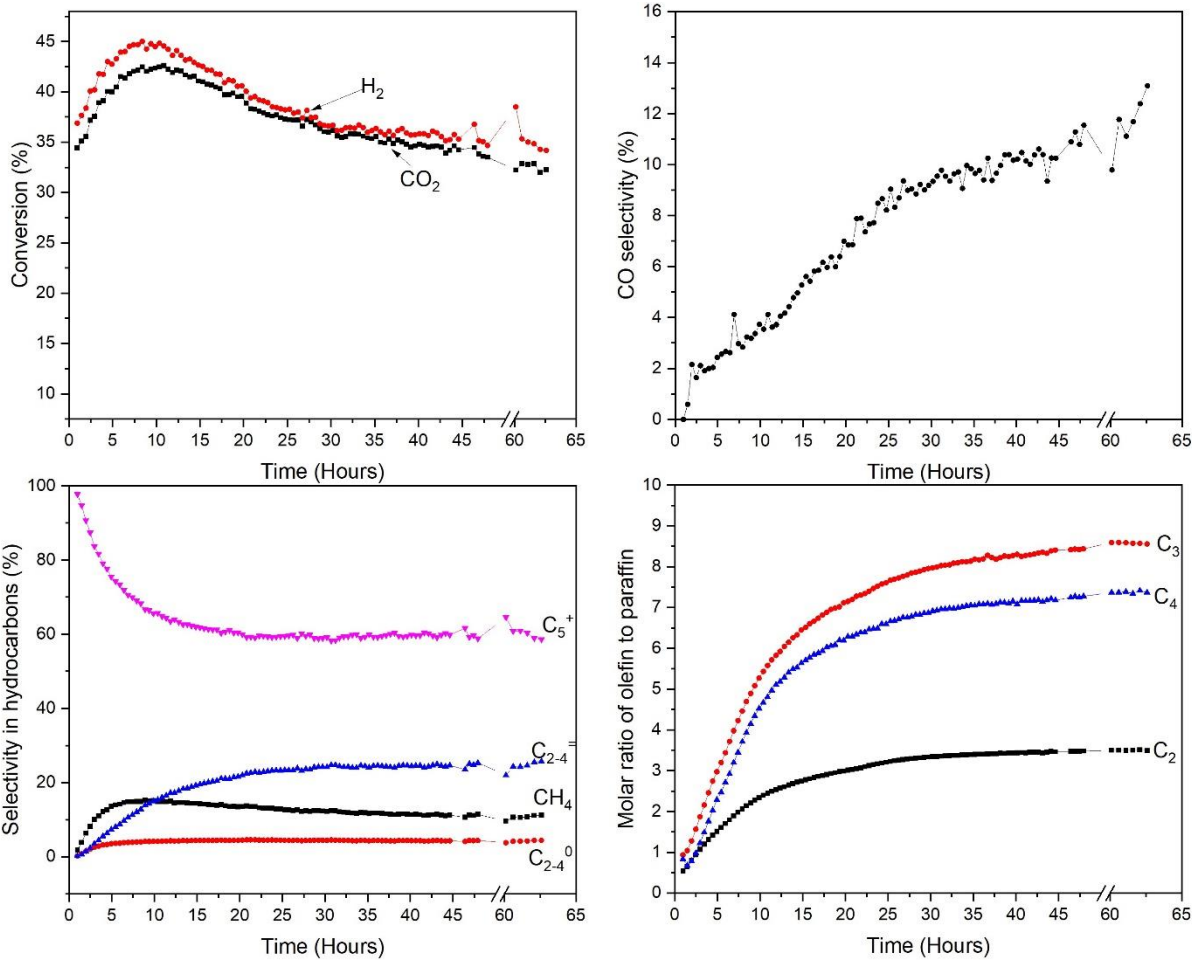
**Supplementary Figure 10 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Mn- K without fuel method**



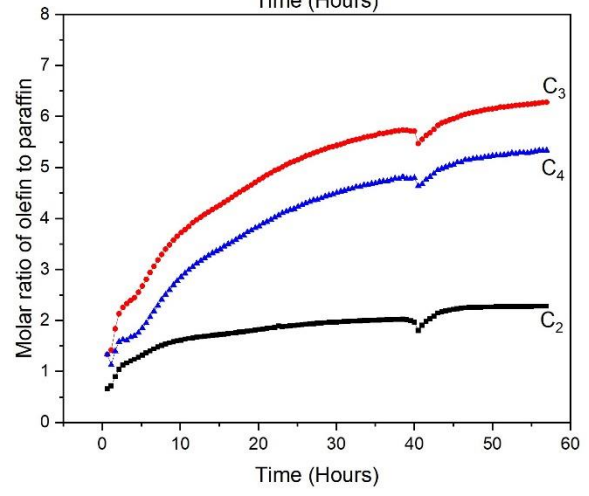
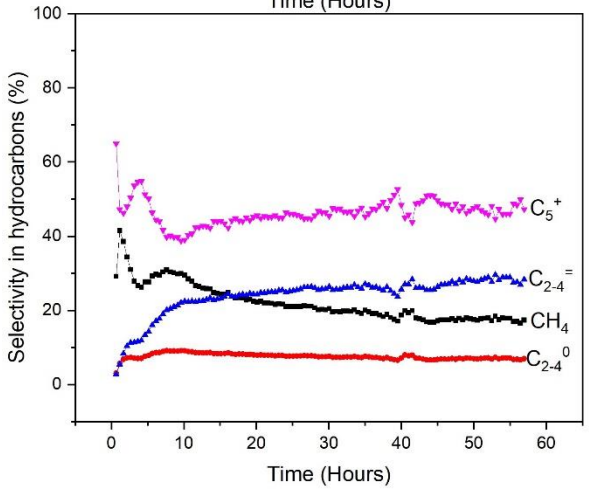
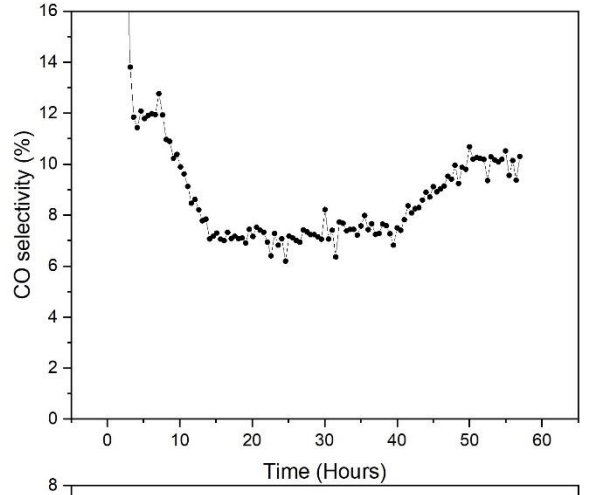
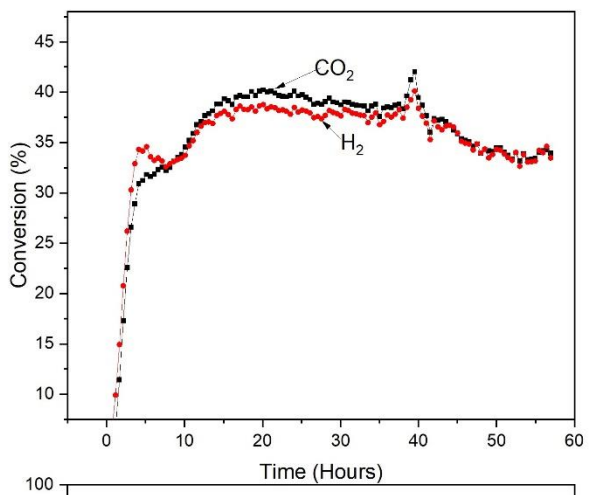
**Supplementary Figure 11 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn- K with urea method**



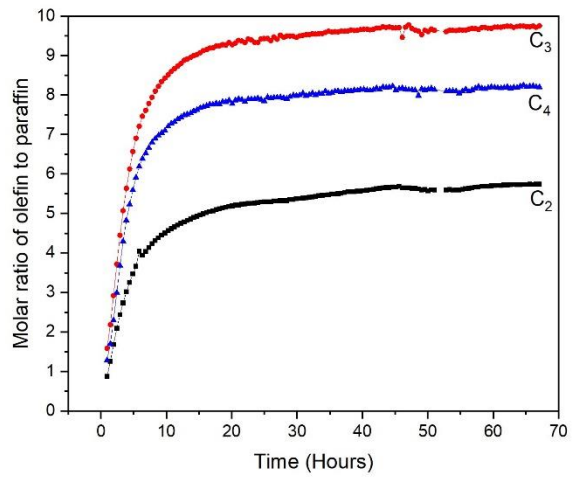
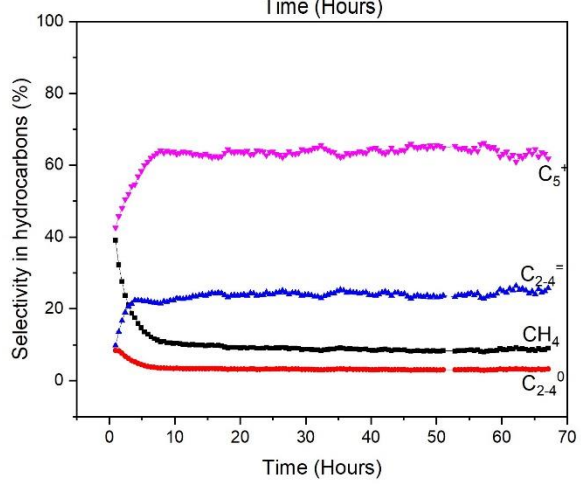
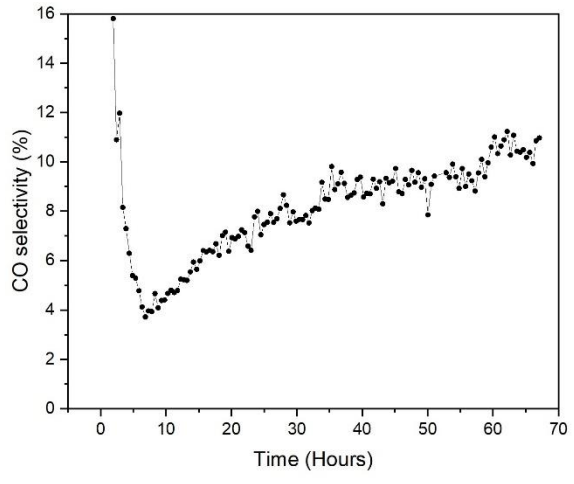
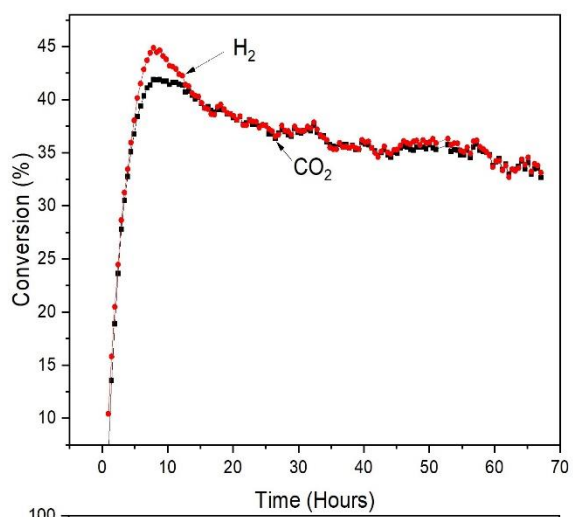
**Supplementary Figure 12 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Mn- K with tannic acid method**



**Supplementary Figure 13 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn- K with EDTA method**

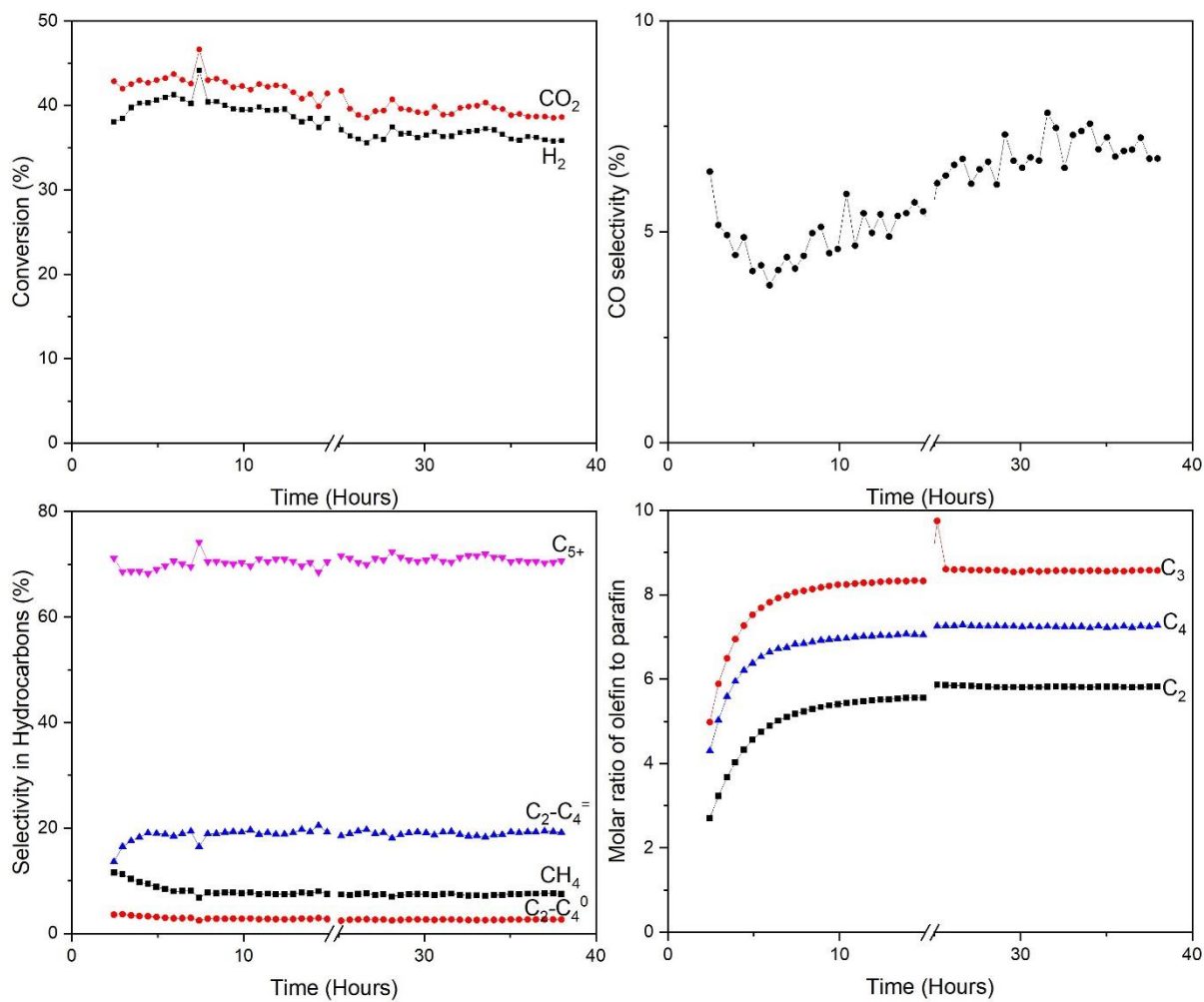


**Supplementary Figure 14 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn- K with glycine method**

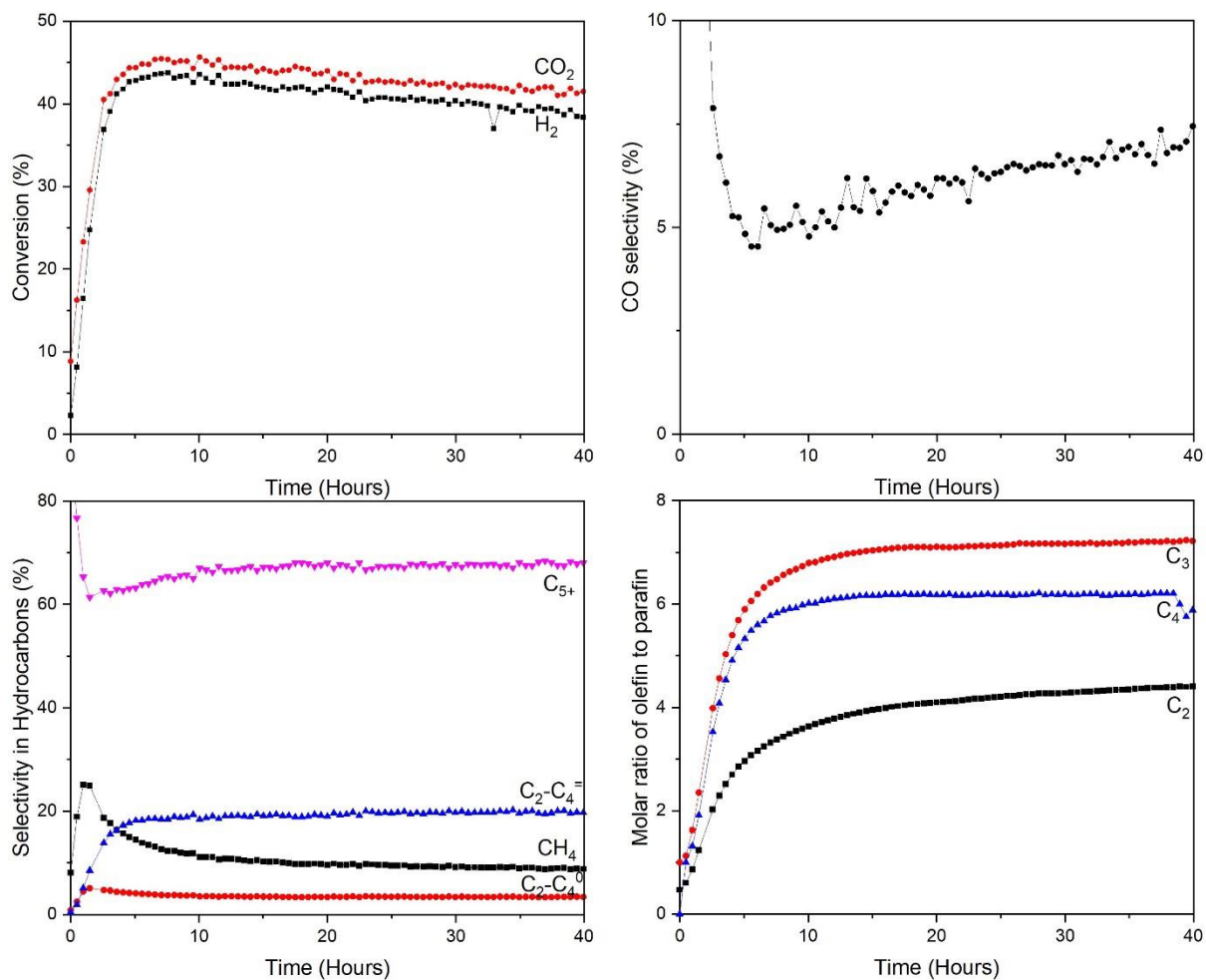


**Supplementary Figure 15 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn- K with oxalic acid method**

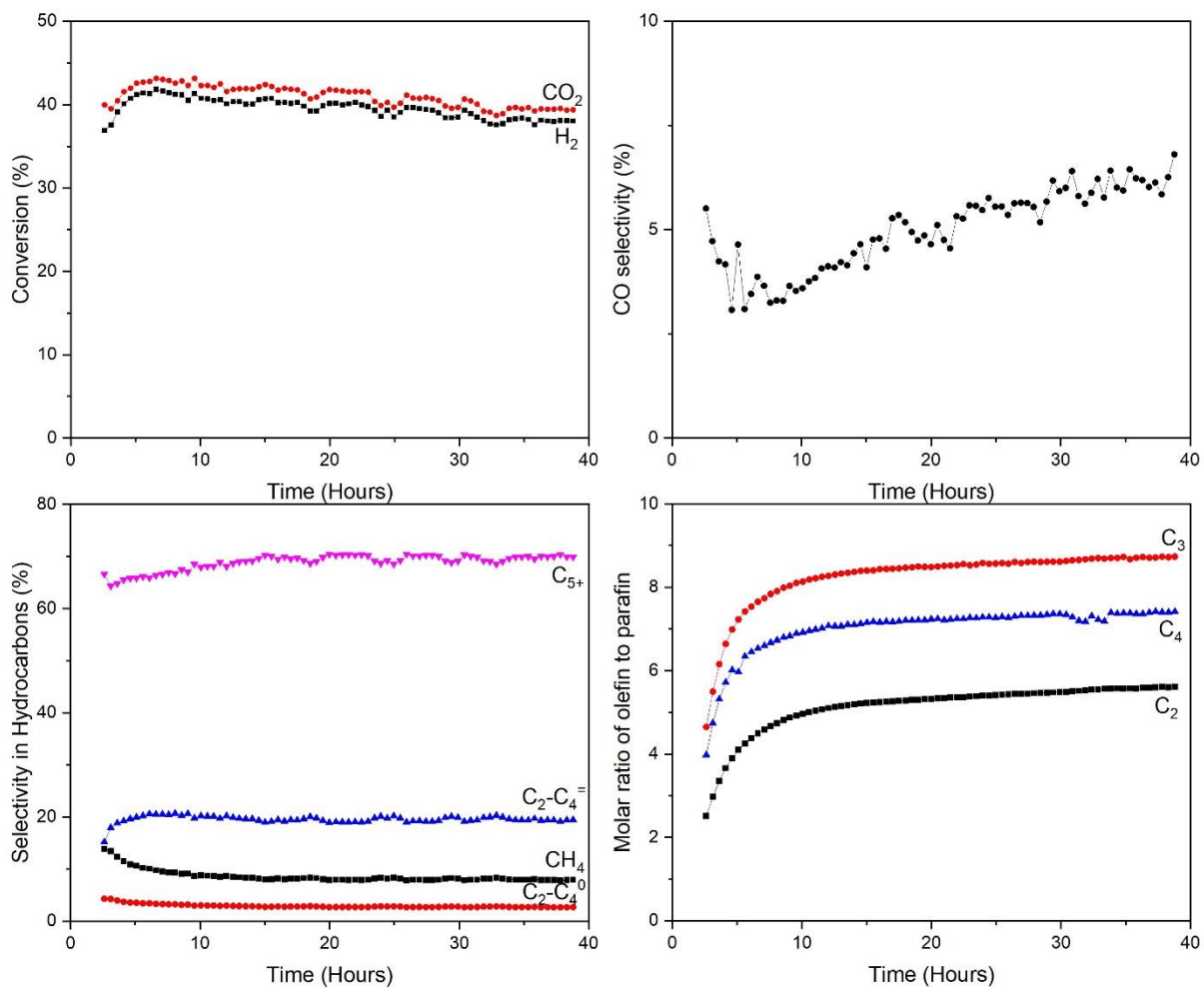




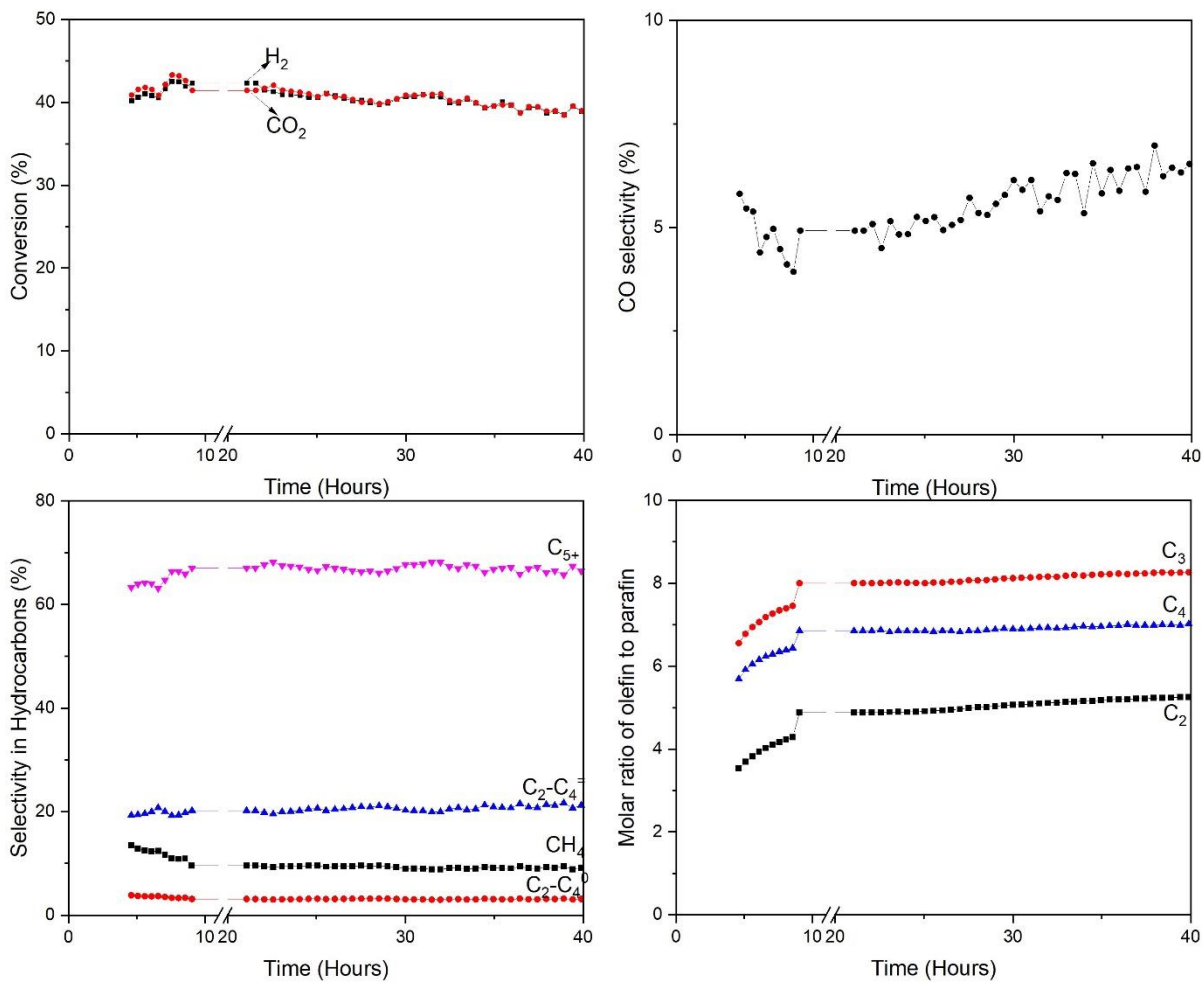
**Supplementary Figure 16 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn-K with NTA method**



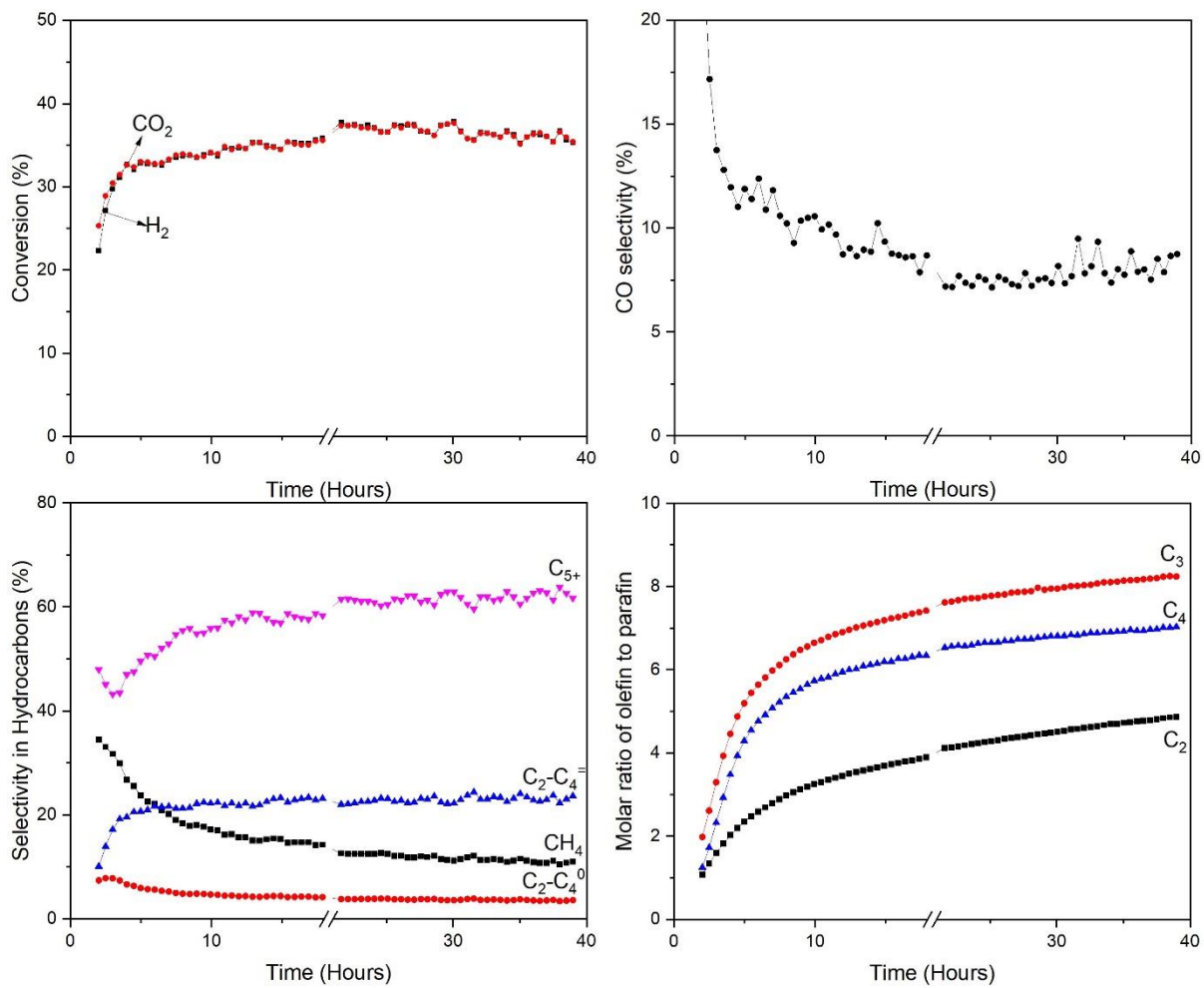
**Supplementary Figure 17 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn-K with DTPA method**



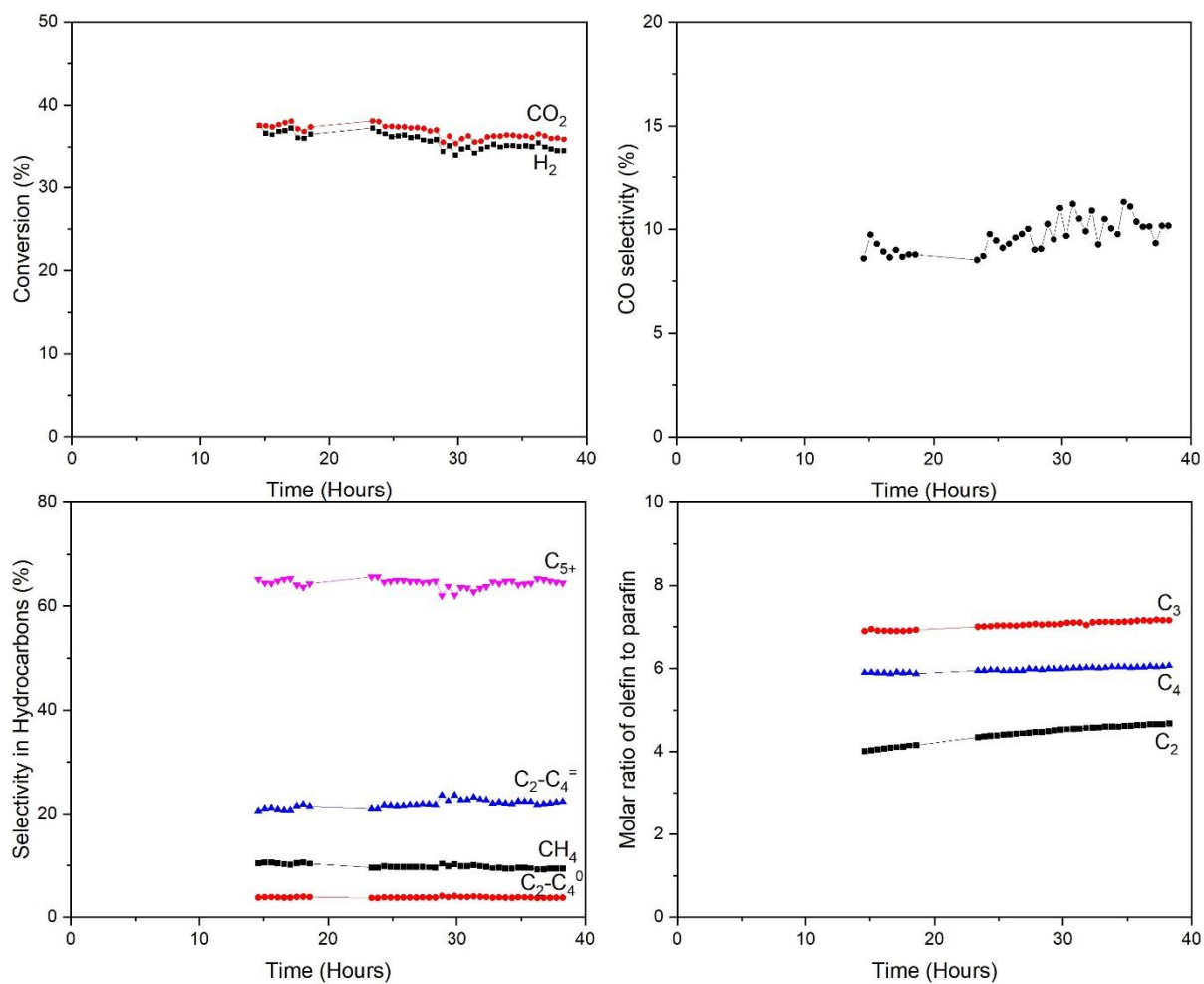
**Supplementary Figure 18 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn-K with tartaric acid method**



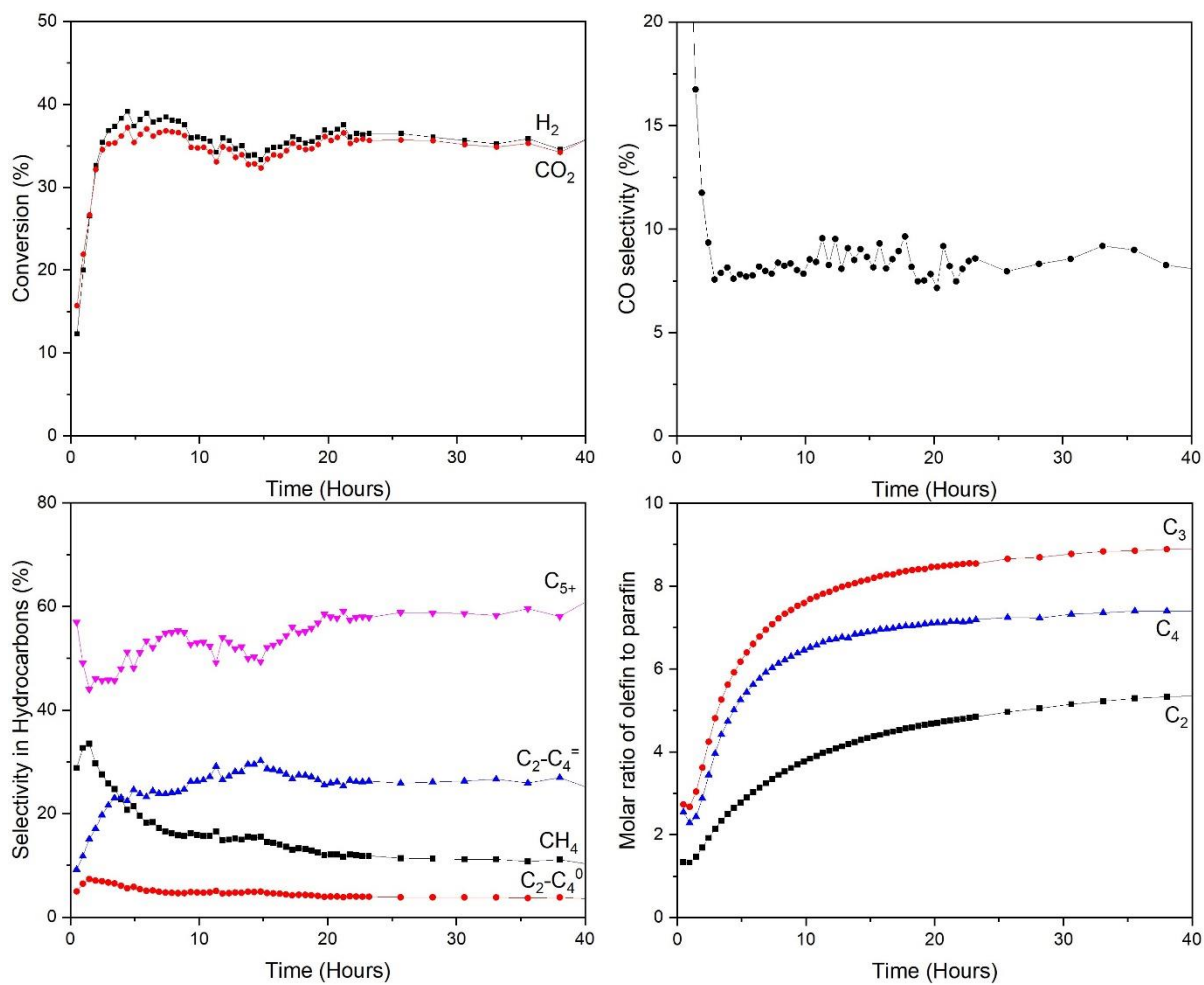
**Supplementary Figure 19 Catalytic performance of CO<sub>2</sub> hydrogenation on catalyst Fe-Mn-K with HEDTA method**



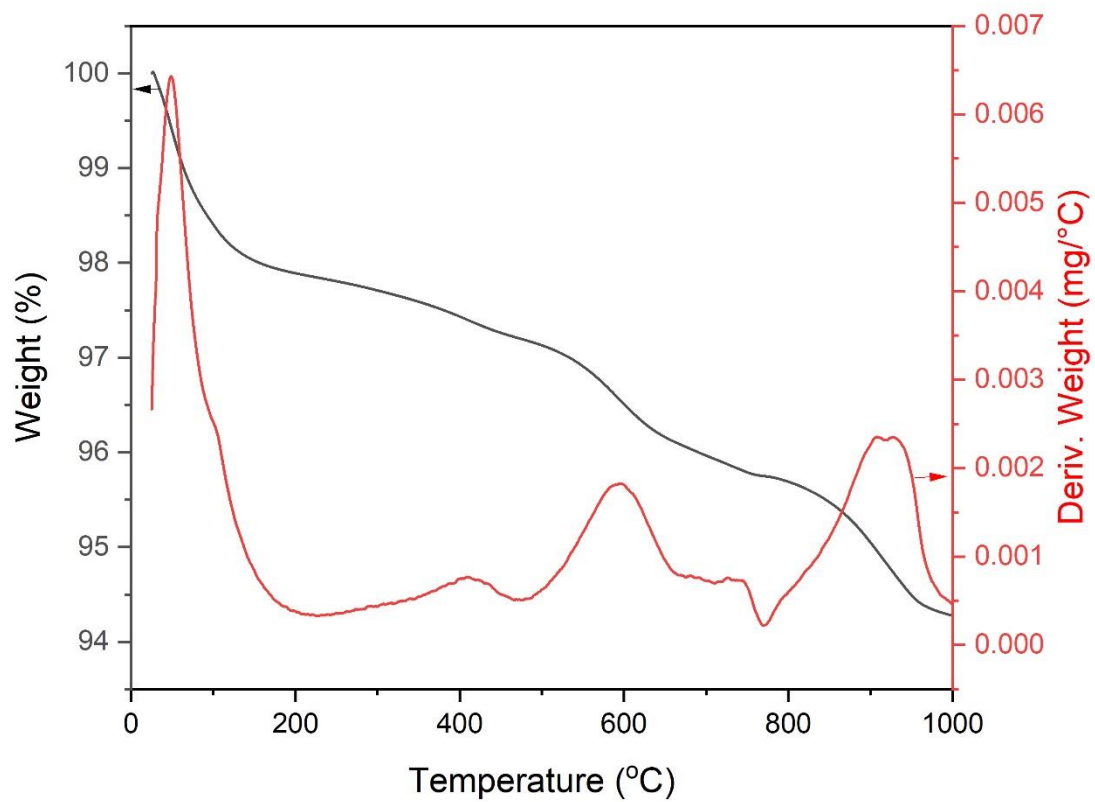
**Supplementary Figure 20 Catalytic performance of  $\text{CO}_2$  hydrogenation on catalyst Fe-Mn-K with Salicylic acid method**



**Supplementary Figure 21 Catalytic performance of  $\text{CO}_2$  hydrogenation on catalyst Fe-Mn-K with sugar method**

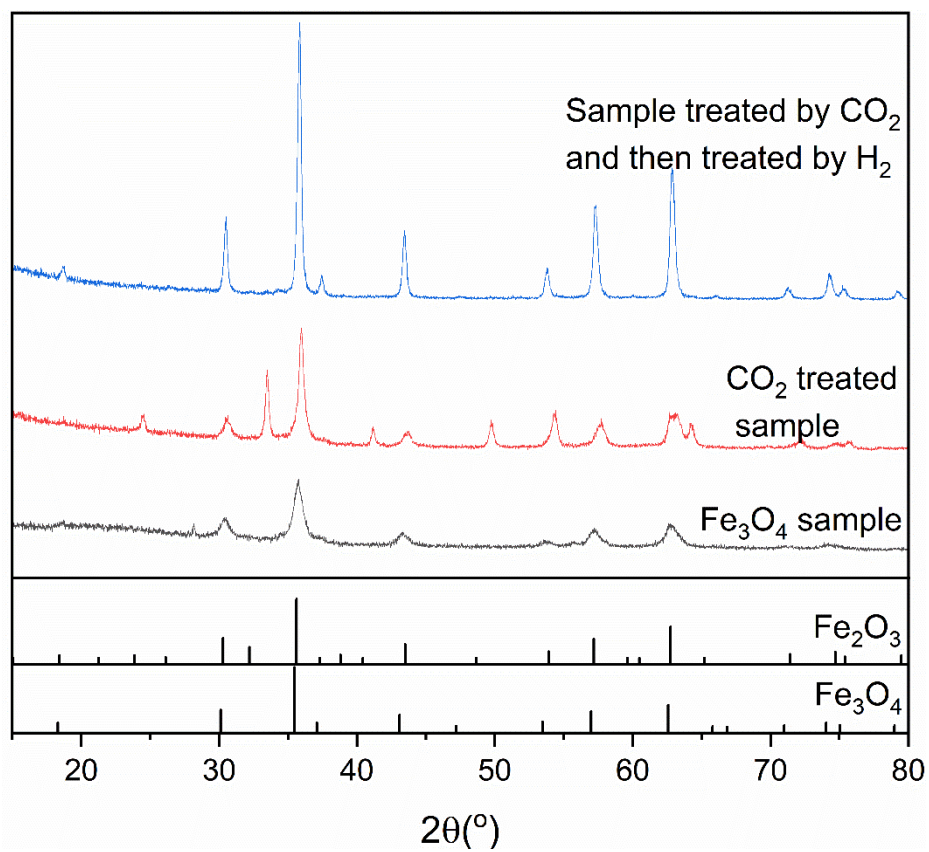


**Supplementary Figure 22 Catalytic performance of  $CO_2$  hydrogenation on catalyst Fe-Mn-K with flour powder method**



Supplementary Figure 23 TGA results of catalyst precursor of Fe-Mn-K (citric acid method)





**Supplementary Figure 24 XRD spectrum of  $\text{Fe}_3\text{O}_4$  sample (black), sample treated at  $\text{CO}_2$  atmosphere 350 °C for 16 hours (red) and sample treated at  $\text{CO}_2$  atmosphere and then treated at 5% $\text{H}_2/\text{N}_2$  atmosphere at 350 °C for 16 hours respectively (blue)**