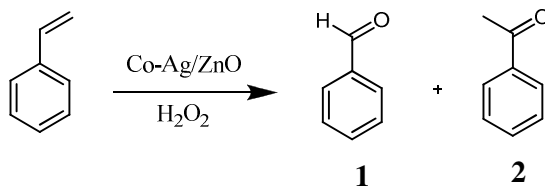
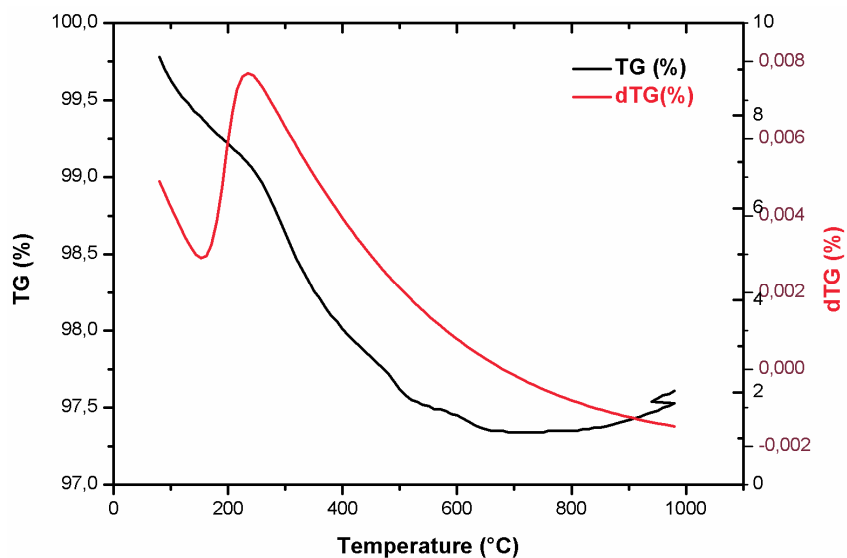


## Supplementary information

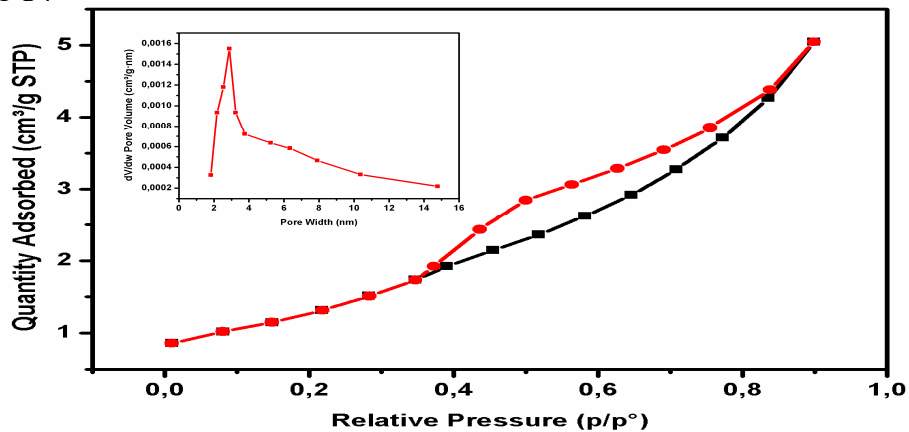
### Supplementary data 1. Catalytic oxidation of styrene.



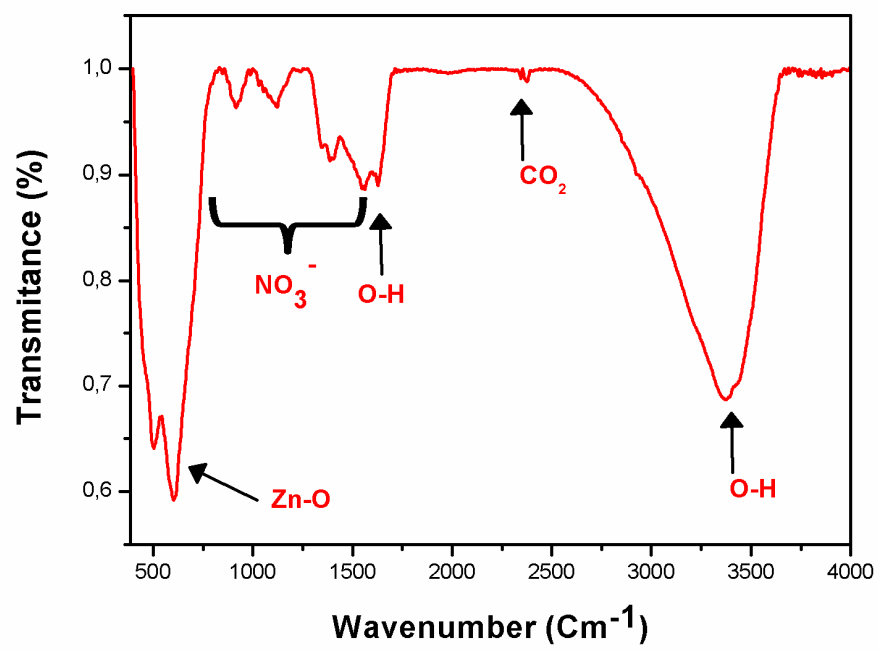
### Supplementary data 2. TG and DTG curves of C4



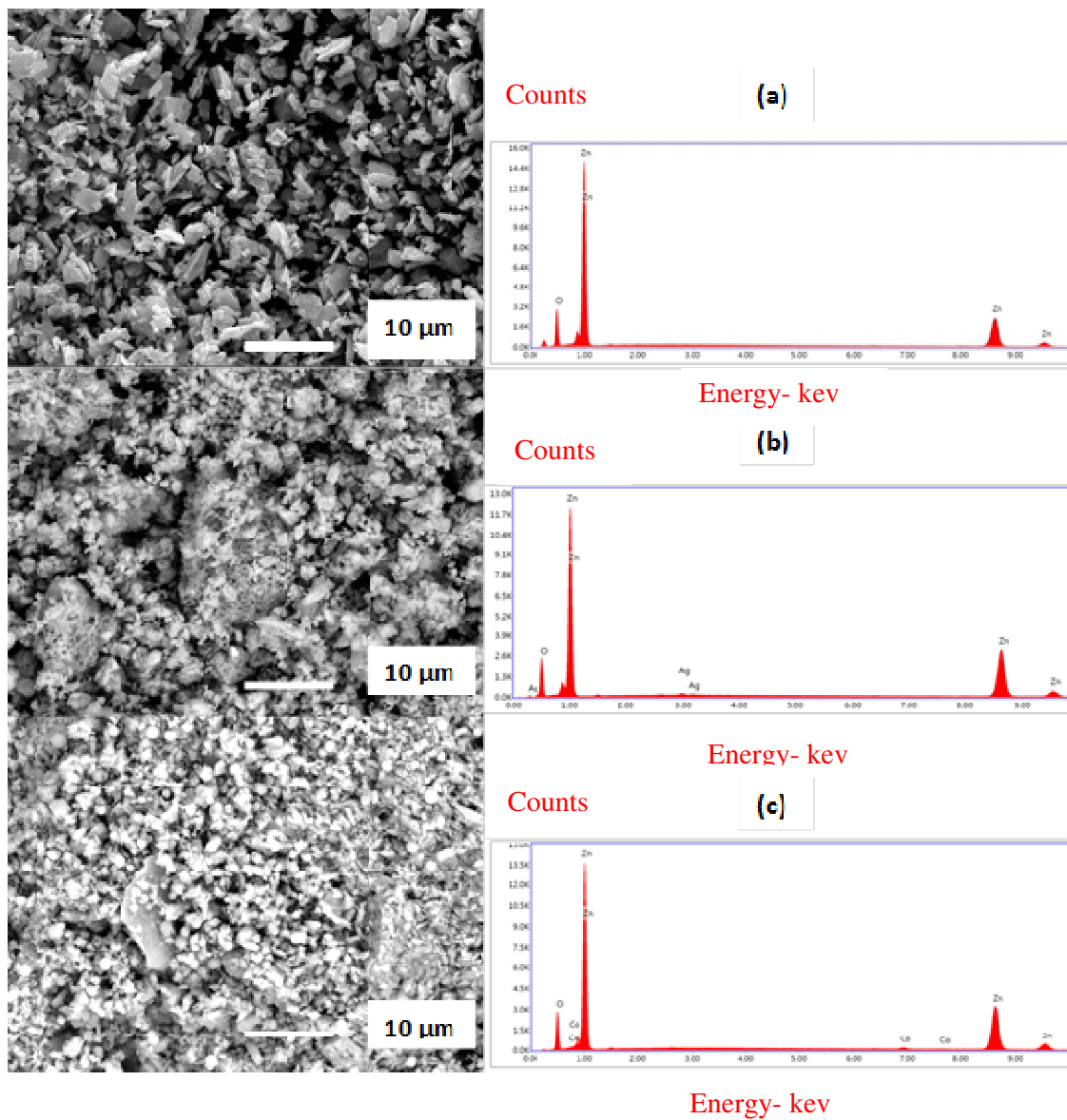
### Supplementary data 3. $\text{N}_2$ adsorption-desorption isotherm and BJH pore diameter distribution of C4

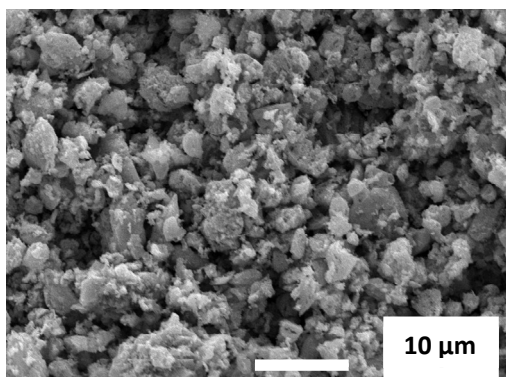


**Supplementary data 4.** FT-IR spectrum of C<sub>4</sub>

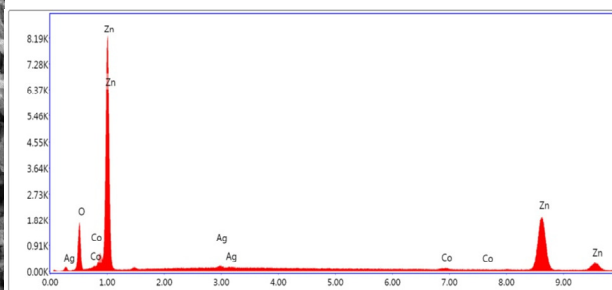


**Supplementary data 5.** SEM images and EDX spectra of: (a): C<sub>1</sub>; (b): C<sub>2</sub>; (c) C<sub>3</sub>; (d): C<sub>4</sub>; (e): C<sub>5</sub>, (f): C<sub>6</sub>; (g): 1<sup>st</sup> Cycle, (h): 2<sup>nd</sup> Cycle, (i): 3<sup>th</sup> Cycle and (j): 4<sup>th</sup> cycles of reused catalyst.



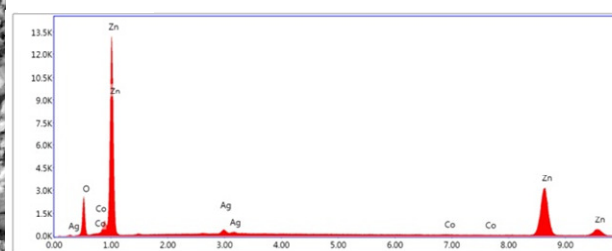
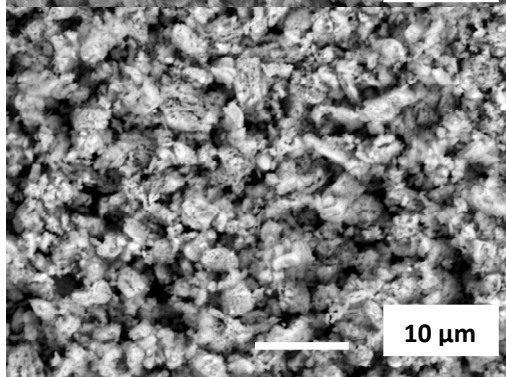


Counts ) (d)



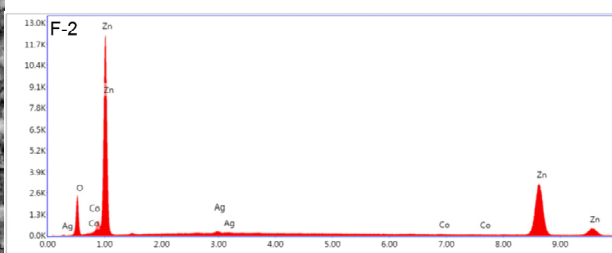
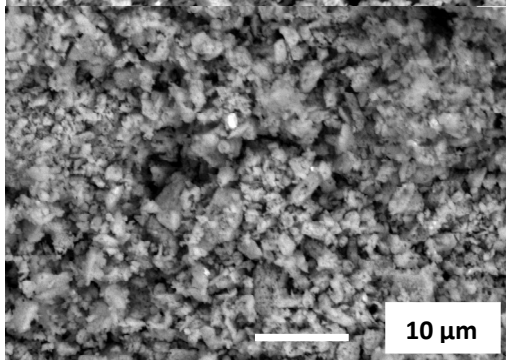
Energy- keV

Counts (e)



Energy- keV

Counts (f)



Energy- keV

