Supporting information for

Continuous hydrogenation of ethyl levulinate to γ-valerolactone and 2-methyl tetrahydrofuran over alumina doped Cu/SiO_2 catalyst: the potential of commercialization

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XRD patterns of H_2 reduced Cu/SiO_2 and Cu/Al_2O_3-SiO_2 catalysts were collected (as shown in Figure 1S), and the Cu particle sizes were calculated by scherrer equation, respectively. After H_2 reduction, the copper particle sizes of Cu/SiO_2 and Cu/Al_2O_3-SiO_2 are 22.40 nm and 19.10 nm, respectively.

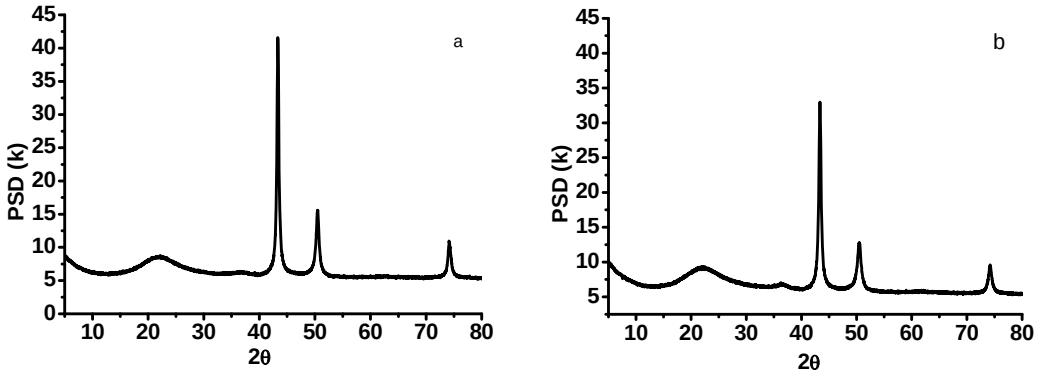

Figure S1. XRD patterns of H_2 reduced Cu/SiO_2 (a) and Cu/Al_2O_3-SiO_2 (b) catalysts.

Figure S2 displays the Py-IR spectroscopy of the Cu/SiO_2 (a) and Cu/Al_2O_3-SiO_2 (b) catalysts desorbed at 200 ^oC, 250 ^oC, 300 ^oC, and 350 ^oC stepwise. Normally, the peak at 1450 cm^{-1} and 1540 cm^{-1} are ascribed to Lewis acidic sites and Brönsted acidic sites, respectively. The Cu/SiO_2 catalyst only has very weak Lewis acidic sites, as indicated by the desorption signal at 200 ^oC and 250 ^oC. Whereas, the Cu/Al_2O_3-SiO_2 catalyst possesses stronger Lewis acidic sites, as indicated by the stronger desorption signals at 200 ^oC and 250 ^oC, as well as the additional desorption signals at 300 ^oC.

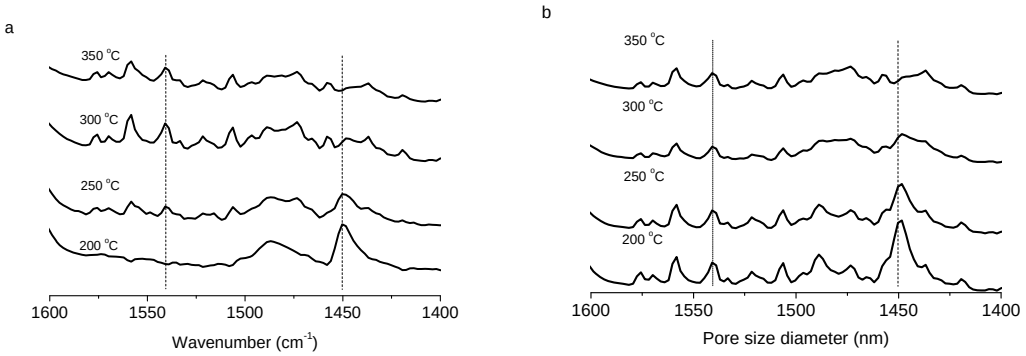

Figure S2. Py-IR characterization of CuO/SiO_2 (a) and CuO/Al_2O_3-SiO_2 (b) catalysts.

Figure S3a shows the TEM micrograph of spent Cu/Al_2O_3-SiO_2 catalyst after 1000 h test. The copper particles are not clearly displayed. The spent catalyst was re-calcined at 500 ^oC for 2 h in the air, and the morphology of CuO particles in TEM micrograph is manifested in Figure S3b. The CuO particles distribute around 20-60 nm. Sintering of Cu particles was not remarkable during long-term operation, which also accounted for the good stability of this Cu/Al_2O_3-SiO_2 catalyst.

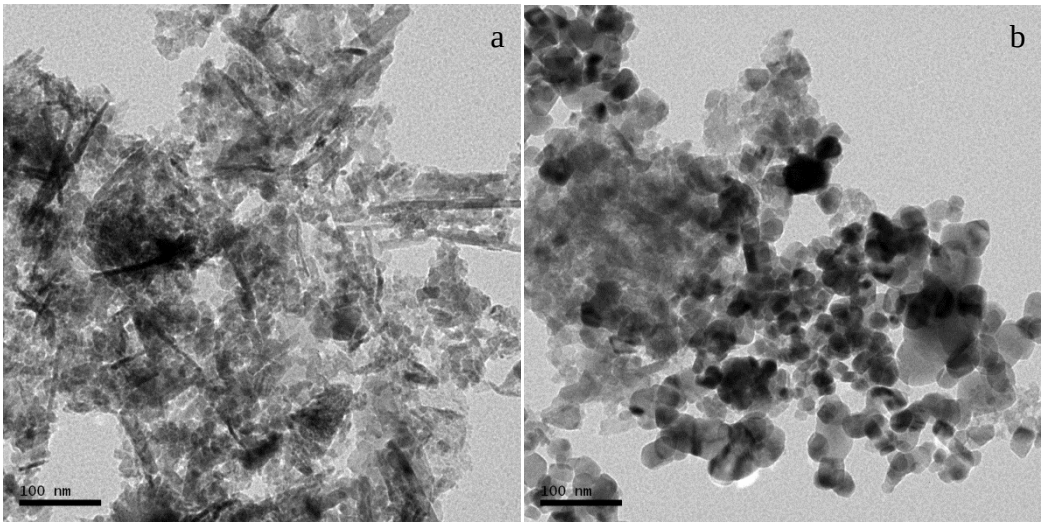

Figure S3. TEM micrographs of spent Cu/Al_2O_3-SiO_2 catalyst: (a) after 1000 h test; (b) re-calcined at 500 ^oC for 2 h in air.