

Effect of Mn doping on the activity and stability of Cu-SiO₂ catalysts for the hydrogenation of methyl acetate to ethanol

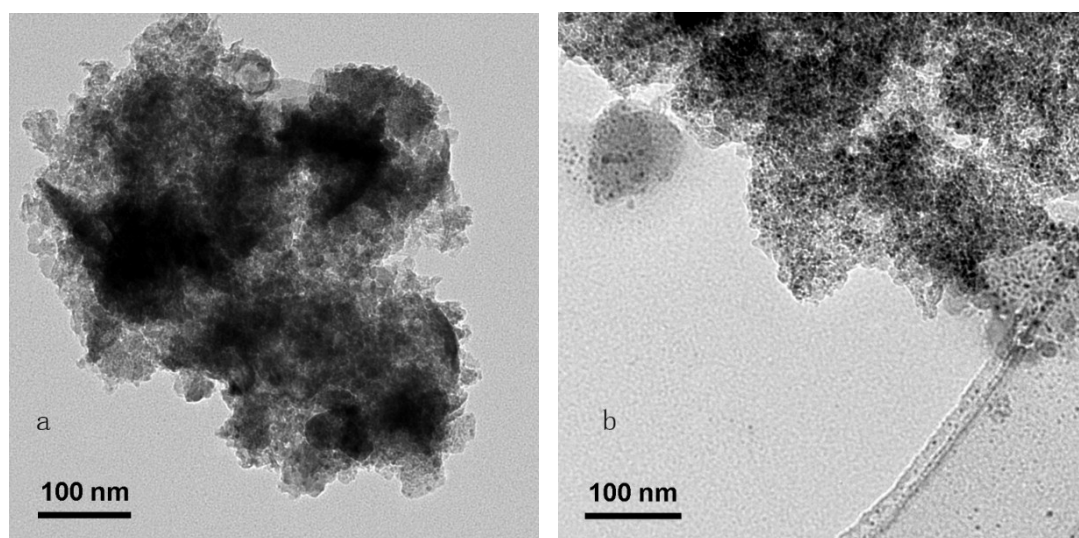


Fig. S1. TEM images of the reduced catalysts. a Cu-SiO₂; b 3Mn-Cu-SiO₂.

To study the external diffusion effect, we measured the catalytic performance under conditions: 40-60 mesh, $T=523$ K, $P=3.0$ MPa, $H_2/MA=15$ (mol/mol), $LHSV=2$ h⁻¹, the catalyst mass changed in the range of 0.994~2.318 g, the H₂ volume flow rate changed in the range of 150~350 mL/min. As shown in Fig. S2, MA conversion was hardly changed with the increase of H₂ volume flow rate from 150~350 mL/min, suggesting the elimination of the external diffusion effect during the assessment experiments (During our activity test, we used 250 ml/min as the H₂ volume flow rate).

To investigate the internal diffusion influence, a series of experiments was carried out with different catalyst particle sizes. The reaction conditions of all the experiments were the same except the particle sizes ($Q=250$ ml/min, $T=523$ K, $P=3.0$ MPa,

$H_2/MA=15$ (mol/mol), $LHSV=2\text{ h}^{-1}$). As illustrated in Fig. S3, MA conversion remained constant when the particle sizes were smaller than 30 mesh, which indicated that the internal diffusion factor could be ignored during our experiments (During our activity test, we used 40-60 mesh as the catalyst particle size).

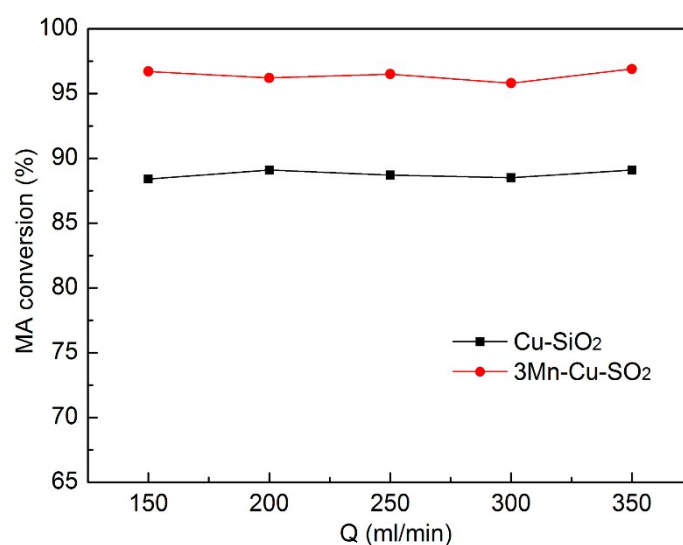


Fig. S2. The effect of external diffusion factor on the catalytic performance. Reaction conditions: 40-60 mesh, $T=523\text{ K}$, $P=3.0\text{ MPa}$, $H_2/MA=15$ (mol/mol), $LHSV=2\text{ h}^{-1}$. (Q : the H_2 volume flow rate).

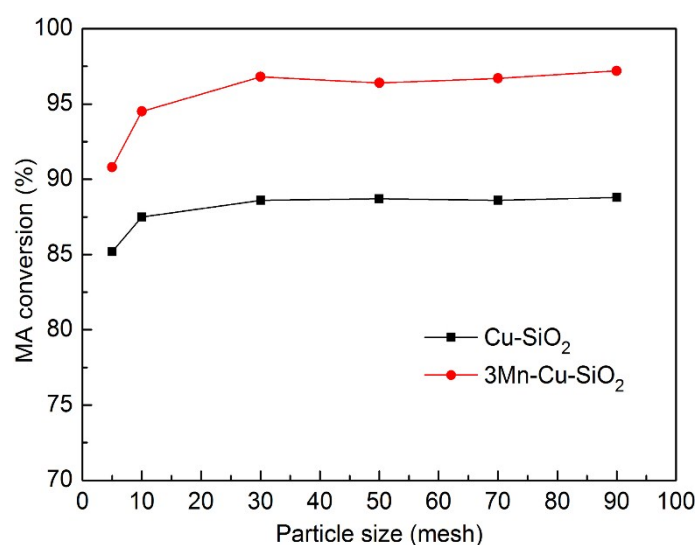


Fig. S3. The effect of internal diffusion factor on the catalytic performance. Reaction

conditions: $Q=250$ ml/min, $T=523$ K, $P=3.0$ MPa, $H_2/MA=15$ (mol/mol), $LHSV=2$ h⁻¹.

(Q : The H₂ volume flow rate).