Selective production of oxygenates from CO$_2$

hydrogenation over mesoporous silica supported Cu-Ga
nanocomposite catalyst

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Figure S1. N₂ adsorption/desorption isotherm plots of supported copper catalysts.
Figure S2. N$_2$ adsorption/desorption plots for Pore size distribution of CuGa/SBA15-UDP a) Before reaction b) reaction recovered catalyst.
Figure S3. XPS study of 16Cu10Ga/SBA15IMP recovered catalyst.
Figure S4. XPS study of 10Cu5Ga/SBA15UDP recovered catalyst.
Figure S5. HRTEM images a) SBA15, b-d) 16Cu10Ga/SBA15-IMP catalysts with different scale.
Table T1. XRF study of prepared supported copper gallium catalysts.

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<tr>
<th>Catalysts</th>
<th>Composition, %</th>
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<tbody>
<tr>
<td></td>
<td>CuO</td>
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<tr>
<td>9Cu/SBA15-IMP-Calcined</td>
<td>9</td>
</tr>
<tr>
<td>16Cu10Ga/SBA15-IMP-Calcined</td>
<td>16</td>
</tr>
<tr>
<td>10Cu5Ga/SBA 15-Urea DP-Calcined</td>
<td>10</td>
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Figure S6. Pyridine desorption on 5Ga/SBA15-UDP; a) activated sample b) 200 °C c) 300 °C d) 400 °C.
Figure S7 2,6-lutidine desorption on 5Ga/SBA15-UDP; a) activated sample b) 200 °C c) 300 °C d) 400 °C.
Figure S8. Pyridine desorption on 10Cu5Ga/SBA15-UDP; a) activated sample b) 200 °C c) 300 °C d) 400 °C.
Figure S9. Pyridine desorption on 9Cu/SBA15-IMP; a) activated sample b) 200 °C c) 300 °C d) 400 °C.
Figure S10. 2, 6-lutidine desorption on 9Cu/SBA15-IMP; a) activated sample b) 200 °C c) 300 °C d) 400 °C.
Figure S11. Effect of temperature on CO₂ conversion and oxygenate selectivity over 10Cu5Ga/SBA15-UDP

Reaction conditions: T= 300 °C, P = 25 bar, Gas Flow (CO₂/Ar/H₂)= 5/5/15 ml/min, GHSV 30000 h⁻¹, CO₂/H₂ = 1:3, Time, 12h.
**Figure S12.** Effect of temperature on CO$_2$ conversion with high residence time over 10Cu5Ga/SBA15-UDP

**Reaction conditions:** T= 200-250 °C, P = 25 bar, Gas Flow (CO$_2$/Ar/H$_2$) = 5/5/15 ml/min, GHSV 4800 h$^{-1}$, CO$_2$/H$_2$ = 1:3, Time, 12h.
Figure S13. Effect of temperature on oxygenate selectivity with high residence time over 10Cu5Ga/SBA15-UDP

**Reaction conditions:** T = 200-250 °C, P = 25 bar, Gas Flow (CO₂/Ar/H₂) = 5/5/15 ml/min, GHSV 4800 h⁻¹, CO₂/H₂ = 1:3, Time, 12h.