Supporting Information

CO$_2$ absorption and desorption characteristics of MgO-based absorbent promoted by triple eutectic alkali carbonate

Jin-Su Kwak$^a$, Kyung-Ryul Oh$^a$, Kang-Yeong Kim$^a$, Jeong-Min Lee$^a$, and Young-Uk Kwon$^{a,b,*}$

$^a$Department of Chemistry, Sungkyunkwan University, Suwon 16419, Korea
$^b$School of Material Science Engineering, Tianjin Polytechnic University, Tianjin 300387, China

*E-mail: ywkwon@skku.edu
**Fig. S1** Time-dependent CO$_2$ absorption data of 60-TEC/MgO absorbent at various temperatures.

**Fig. S2** Time-dependent CO$_2$ absorption data of x-TEC/MgO absorbents (x = 20, 40, 60, 80 and 100) in the conventional unit of % weight gain, redrawn from Fig. 1.
Fig. S3 Time-dependent CO$_2$ absorption data of dummy 60-TEC/Y$_2$O$_3$ absorbent.

Fig. S4 Time-dependent TGA data of pure TEC at 370 °C under 100% CO$_2$. 
Fig. S5 In-situ XRD data of x-TEC/MgO absorbents before and after pre-treatment. (a) x = 20, (b) 60, and (c) 100.
Fig. S6 N\textsubscript{2} adsorption and desorption, pore size distributions of MgO (reference), 20- and 100-TEC/MgO absorbents

Fig. S7 Comparison of XRD pattern of phase 1 with other known related phases in the literature.
**Fig. S8** Peak indexation results of phase 1 formed in 60-TEC/MgO absorbent after 180 min of CO₂ absorption.

**Fig. S9** (Upper panels) Variations of ex-situ XRD peak intensities of phase 1 and MgCO₃ in (a) 60- and (b) 100-TEC/MgO absorbents as a function of time spent at 360 °C under 100% CO₂. The intensity data are normalized values against the intensities of respective phases at 180 min. The intensity data were obtained by integrating a representative peak in each phase as marked in the figure. (Lower panels) Time-dependent CO₂ absorption data of respective absorbents taken from Fig. 1 for comparison.

**Table S1.** Lattice parameters of MgO phases in pure MgO and x-TEC/MgO absorbents after pre-
treatment of heating at 400 °C under 100% N₂.

<table>
<thead>
<tr>
<th></th>
<th>Lattice parameter (Å)(^a)</th>
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<tbody>
<tr>
<td>MgO</td>
<td>4.218(2)</td>
</tr>
<tr>
<td>20-TEC/MgO</td>
<td>4.204(2)</td>
</tr>
<tr>
<td>60-TEC/MgO</td>
<td>4.204(2)</td>
</tr>
<tr>
<td>100-TEC/MgO</td>
<td>4.205(2)</td>
</tr>
</tbody>
</table>

\(^a\)Calculated by the least-squares method of the peak positions of MgO in the diffraction patterns in Fig. S5.