Supplementary Material: H-ZSM-5 Materials Embedded in an Amorphous Silica Matrix: Highly Selective Catalysts for Propylene in Methanol-to-Olefin Process

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Figure S1. FT-IR spectra for investigated samples
Figure S2. NH₃-TPD patterns of the samples

Figure S3. FT-IR spectra of the samples after CO adsorption in the region of 2260-2100 cm⁻¹, the band at 2230 cm⁻¹ corresponding to the strong Lewis acid sites.

Table S1. Quantification data obtained from FT-IR spectra after CO adsorption (9.9 mbar pressure).

<table>
<thead>
<tr>
<th>Samples</th>
<th>Area under peak 2175 cm⁻¹ (B)</th>
<th>Area under peak 2156 cm⁻¹ (C)</th>
<th>Area under peak 2137 cm⁻¹ (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFI-40</td>
<td>0.50</td>
<td>4.6</td>
<td>0.45</td>
</tr>
<tr>
<td>MFI-45</td>
<td>0.05</td>
<td>9.1</td>
<td>6.53</td>
</tr>
<tr>
<td>MFI-50</td>
<td>0.02</td>
<td>8.8</td>
<td>6.48</td>
</tr>
<tr>
<td>Zeolyst</td>
<td>30.9</td>
<td>1.2</td>
<td>30.9</td>
</tr>
</tbody>
</table>
Figure S4. Selectivity patterns for C3+/C2+ ratio of synthesized H-ZSM-5 and Zeolyst reference sample for the MTO reaction at reaction temperature of 500°C and WHSV of 3 h⁻¹; a) MFI-40, b) MFI-45, c) MFI-50, and d) Zeolyst reference.

Figure S5. Operando UV-vis spectra collected during the MTO reaction over a) MFI-40; b) MFI-45; c) MFI-50 and d) Zeolyst; WHSV: 3h⁻¹, reaction temperature: 500°C. The green colored spectra...
corresponds to the initial stage of reaction; where the products formation is initiated, the red colored spectra indicate to the stable/slower deactivation; where the products formation reach to the steady state, and the black colored spectra relates to the deactivated stage; where the products formation was decreased drastically.

**Figure S6.** The GC image for running MTO reaction of synthesized HZSM-5 (Si/Al = 50) sample.

**Scheme S1.** The dual-cycle mechanistic concepts for conversion of methanol-to-olefins reaction over HZSM-5 catalysts

**References**