Electronic Supplementary Information

**S1. Catalyst Characterization.** N₂ physisorption and volumetric chemisorption measurements were performed using a Micromeritics ASAP 2020c instrument. The Brunauer-Emmett-Teller (BET) method was used to determine the total (physical) surface area. CO chemisorption was conducted on 5 wt% Pd/C at 35°C after *in situ* reduction at 300 °C for 1 h. Pd dispersion was calculated based on strongly adsorbed CO (difference isotherm method) assuming a CO:Pd surface atom stoichiometric ratio of 0.5:1. The 5 wt% Pd/C catalyst had a BET surface area of 855 m²/g and a Pd dispersion of 19.5% (average particle size ~5.6 nm). The calcined Pt/CaY catalyst had a BET surface area of 706 m²/g. H₂ chemisorption was conducted starting with a calcined Pt/CaY sample, as follows: heating under vacuum to 400 °C at 20°C/min, 30 min reduction with H₂ at 400°C, 2 h evacuation at 400°C, cooling to 35 °C at 10°C/min, 10 min evacuation at 35°C, leak test at 35°C, 1 h evacuation at 35°C, and analysis at 35°C. The reduced Pt/CaY catalyst exhibited H/Pt ratios 1.04 and 0.447, for total and strongly adsorbed hydrogen, respectively.
Table S1. Product moles of BHMA, 2-C_{13}-OH, and 2-C_{13}-ONE deoxygenation over 5 wt% Pd/C at 300 °C and 15 bar under 5 vol% H2. Reactant charge was 5.6 mmol or 5.9 mmol (2-C_{13}-ONE).

<table>
<thead>
<tr>
<th>Feed</th>
<th>Gas (mmol)</th>
<th>Liquid (mmol)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO</td>
<td>CO2</td>
<td>CH4</td>
<td>H2</td>
<td>n-C_{11}</td>
<td>n-C_{13}</td>
<td>2-C_{13} -ONE</td>
<td>2-C_{13} -OH</td>
</tr>
<tr>
<td>BHMA</td>
<td>0.78</td>
<td>4.34</td>
<td>0.32</td>
<td>0.16</td>
<td>0.78</td>
<td>2.17</td>
<td>1.52</td>
<td>0.32</td>
</tr>
<tr>
<td>2-C_{13}-OH</td>
<td>0.40</td>
<td>0.09</td>
<td>0.25</td>
<td>3.68</td>
<td>0.62</td>
<td>0.22</td>
<td>3.23</td>
<td>0.22</td>
</tr>
<tr>
<td>2-C_{13}-ONE</td>
<td>0.31</td>
<td>0.06</td>
<td>0.23</td>
<td>-1.30</td>
<td>0.50</td>
<td>0.18</td>
<td>4.01</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Table S1 shows the moles of gaseous and liquid products formed by the reactions of BHMA, 2-C_{13}-ONE, and 2-C_{13}-OH. Moles of unknown product were estimated as the difference between reactant moles and product moles that could be accounted for with all identified products.

Larger quantities of \(n\)-C_{11} than \(n\)-C_{13} were produced in these reactions, and the overall \(n\)-alkane yields after 4 h are <15% (Table S1). Dehydrogenation to 2-C_{13}-ONE was the primary reaction pathway for 2-C_{13}-OH. 2-C_{13}-ONE was relative unreactive, producing only small quantities of \(n\)-C_{11}, 2-C_{13}-OH, \(n\)-C_{13}, and the unknown compound. A higher yield of the unknown compound was produced from 2-C_{13}-OH than BHMA or 2-C_{13}-ONE.
Figure S1. Photo of vial containing crude CBFA sample (FA03).
Figure S2. Chromatograms of standards and BHMA deoxygenation product with species identification: (a) 2-C_{13}-ONE, (b) 2-C_{13}-OH and (c) BHMA reactor contents.
Figure S3. Photo of vial containing mixture of linear and branched alkanes produced from FA08A via deoxygenation over Pd/C and subsequent hydroisomerization over Pt/CaY.