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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.

	Products								
	Gas (mmol)				Liquid (mmol)				
Feed	CO	CO ₂	CH ₄	H ₂	<i>n</i> -C ₁₁	<i>n</i> -C ₁₃	2-C ₁₃ -ONE	2-С ₁₃ -ОН	Unknown
BHMA	0.78	4.34	0.32	0.16	0.78	2.17	1.52	0.32	0.81
2-C ₁₃ -OH	0.40	0.09	0.25	3.68	0.62	0.22	3.23	0.22	1.31
2-C ₁₃ -ONE	0.31	0.06	0.23	-1.30	0.50	0.18	4.01	0.22	0.69

Table S1. Product moles of BHMA, 2-C₁₃-OH, and 2-C₁₃-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-C₁₃-ONE).

Table S1 shows the moles of gaseous and liquid products formed by the reactions of BHMA, 2-C₁₃-ONE, and 2-C₁₃-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*-C₁₁ than *n*-C₁₃ were produced in these reactions, and the overall *n*-alkane yields after 4 h are <15% (Table S1). Dehydrogenation to 2-C₁₃-ONE was the primary reaction pathway for 2-C₁₃-OH. 2-C₁₃-ONE was relative unreactive, producing only small quantities of *n*-C₁₁, 2-C₁₃-OH, *n*-C₁₃, and the unknown compound. A higher yield of the unknown compound was produced from 2-C₁₃-OH than BHMA or 2-C₁₃-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.