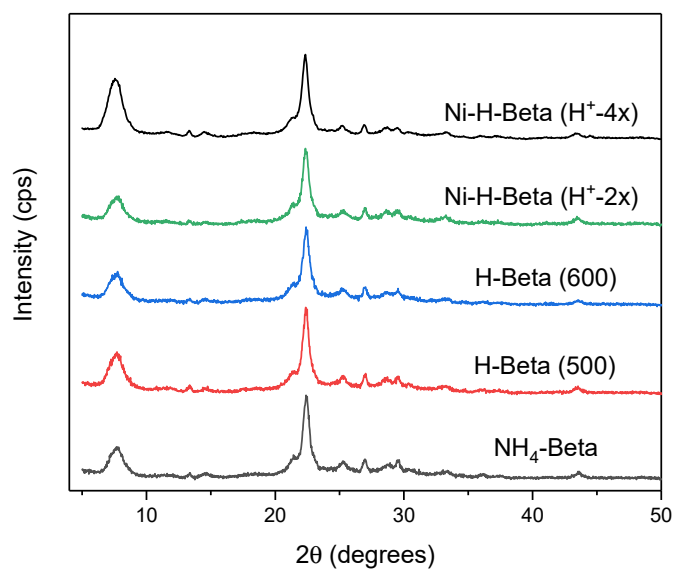
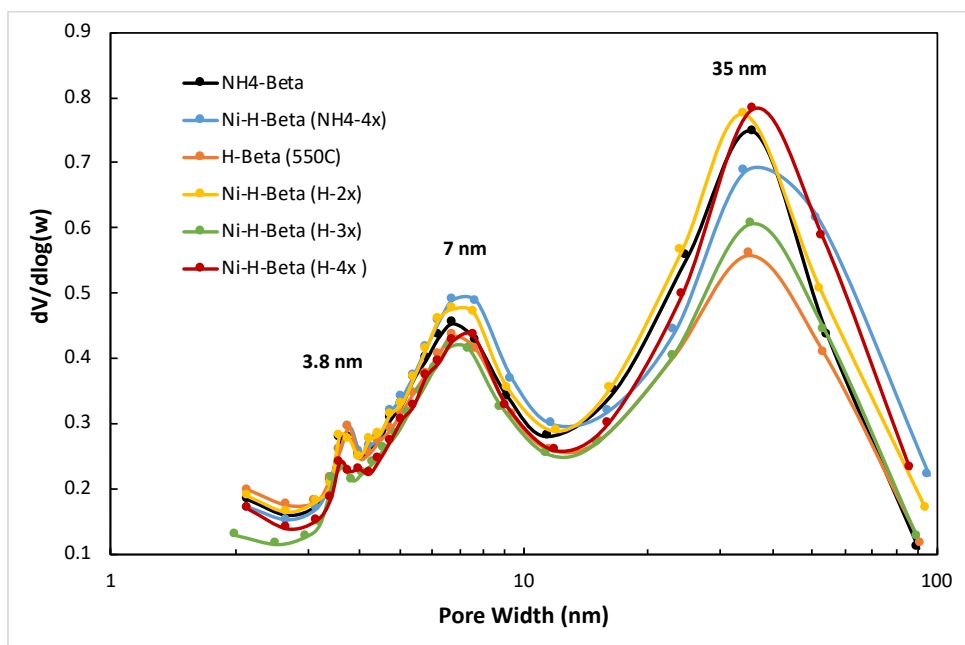


**Supplementary Information for**  
**Ni-H-Beta Catalysts for Ethylene Oligomerization: Impact of Parent**  
**Cation on Ni Loading, Speciation, and Siting**

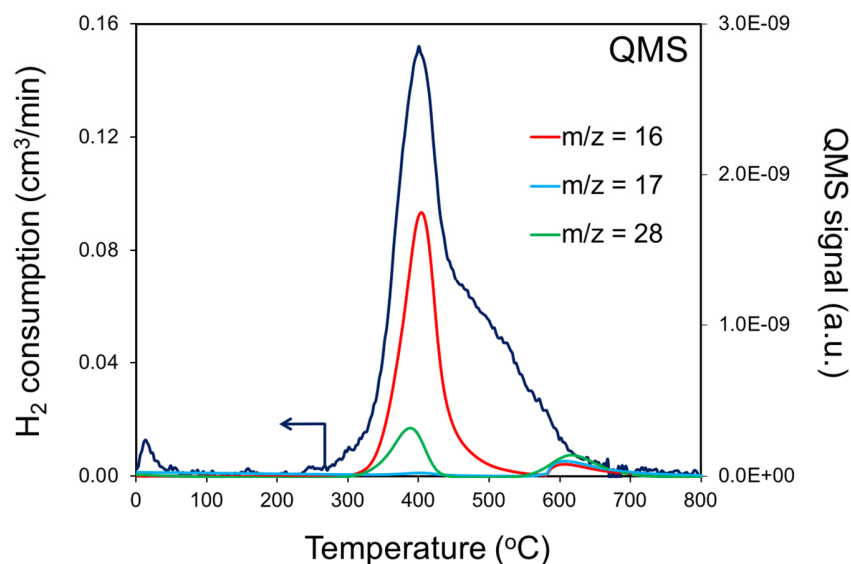
Joseph McCaig and H. Henry Lamb  
Chemical and Biomolecular Engineering  
North Carolina State University  
Raleigh, NC 27695



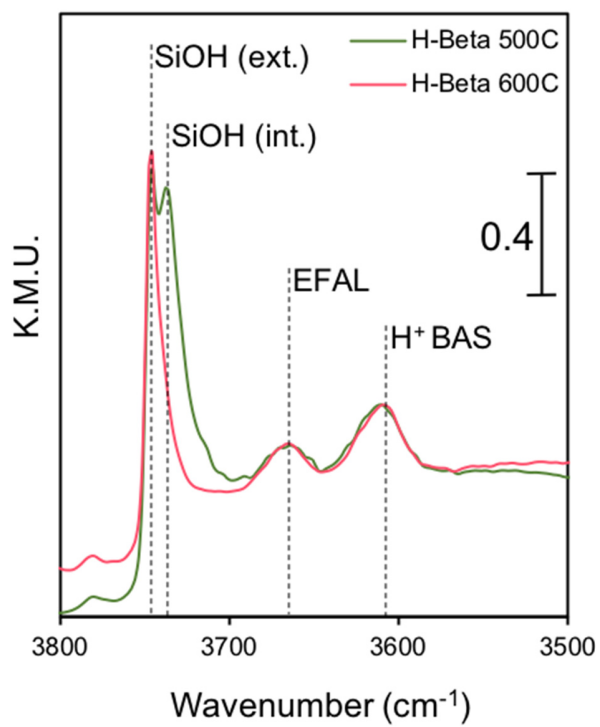
**Figure S1:** X-ray diffraction (XRD) powder patterns of the parent zeolites and selected Ni-H-Beta (H<sup>+</sup>-*nx*) catalysts.



**Figure S2:** Pore size distributions of parent zeolites and Ni-H-Beta catalysts calculated from 77K N<sub>2</sub> desorption data using the BJH method.



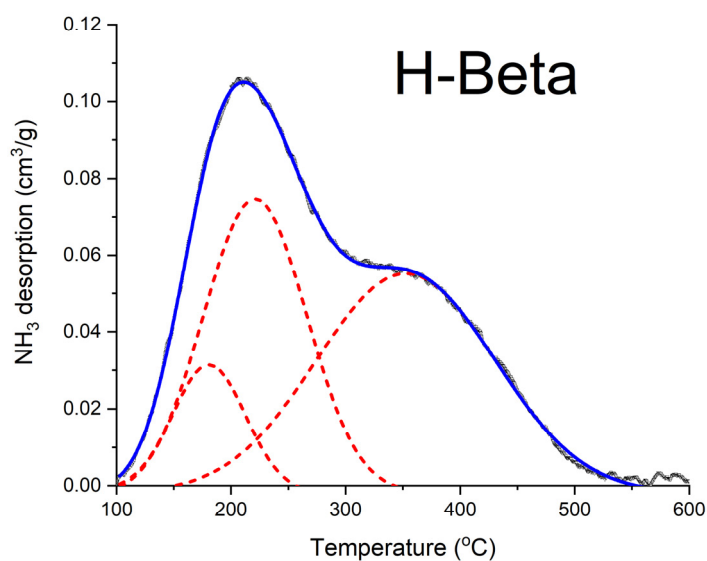
**Figure S3:** H<sub>2</sub> TPR of Ni-NH<sub>4</sub>-Beta following pretreatment at 300°C in He monitored by TCD and QMS (secondary axis). H<sub>2</sub> consumption (TCD) and QMS signals of CH<sub>4</sub> (m/z = 16), NH<sub>3</sub> (m/z = 17), and N<sub>2</sub> (m/z = 28) are shown.



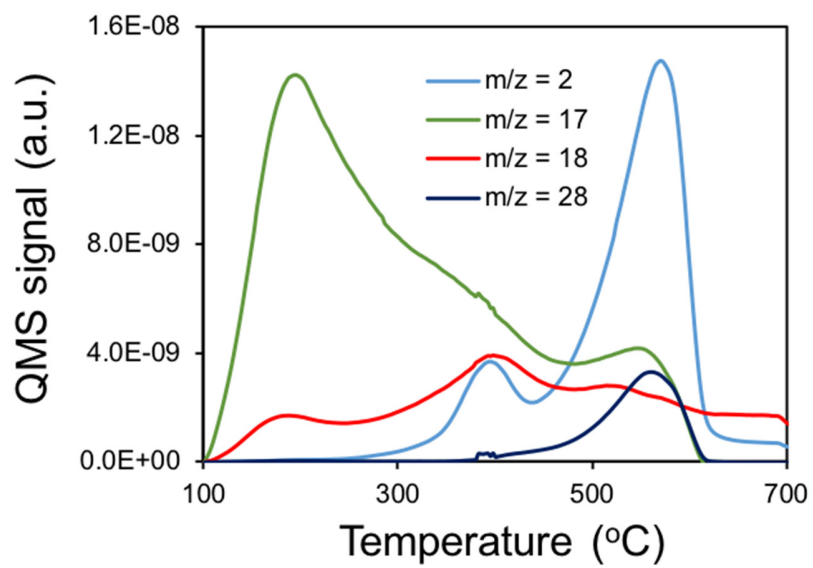
**Figure S4:**  $\nu(\text{OH})$  DRIFT spectra of H-Beta produced by calcination of  $\text{NH}_4$ -Beta at 500 and 600°C in flowing air. Samples were pretreated *in situ* at 350°C in the DRIFTS cell.

**Table S1:** CO DRIFTS peak proportions for Ni-Beta catalysts. Deconvolutions performed on commercial ORIGIN software.

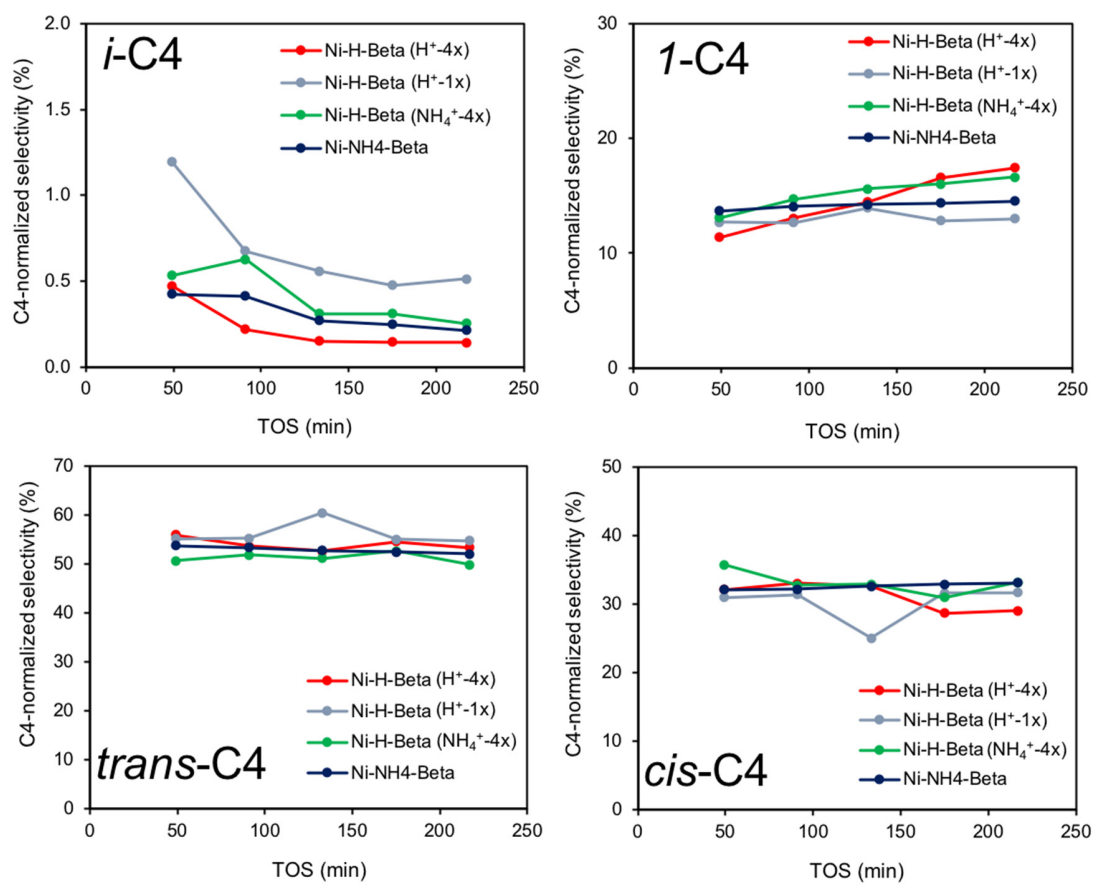
Sample	CO DRIFTS peak fractions		CO DRIFTS peak areas (KMU/cm)	
	2211 cm <sup>-1</sup>	2203 cm <sup>-1</sup>	2211 cm <sup>-1</sup>	2203 cm <sup>-1</sup>
Ni-H-Beta (H <sup>+</sup> -4x)	0.72	0.28	13.3	5.2
Ni-H-Beta (NH <sub>4</sub> <sup>+</sup> -4x)	0.73	0.27	13.5	4.9
Ni-NH <sub>4</sub> -Beta	0.59	0.41	5.5	3.9
Ni-H-Beta (Na <sup>+</sup> -4x)	0.68	0.32	20.8	9.9
Ni-H-Beta (Na <sup>+</sup> -1x)	0.71	0.29	18.9	7.7



**Figure S5:** NH<sub>3</sub> TPD of H-Beta following pretreatment at 500°C in He. Peak deconvolutions performed on ORIGIN software.



**Figure S6:** NH<sub>3</sub> TPD of Ni-NH<sub>4</sub>-Beta following pretreatment at 300°C in He monitored by on-line QMS.



**Figure S7:** EO butene selectivities for Ni-Beta catalysts following activation at 300°C in N<sub>2</sub>. T = 225°C, P = 11 bar, WHSV = 3 h<sup>-1</sup>.