

Flexible NiCo Based Catalyst for Direct Hydrodeoxygenation of Guaiacol to Cyclohexanol

Changzhou Chen ^{ac}, Minghao Zhou ^{bd*}, Peng Liu ^{ac}, Brajendra K Sharma ^d,

Jianchun Jiang ^{ac*}

- a. Institute of Chemical Industry of Forest Products, Chinese Academy of Forestry; Key Lab. of Biomass Energy and Material, Jiangsu Province; National Engineering Lab. for Biomass Chemical Utilization; Key and Open Lab. on Forest Chemical Engineering, SFA, Nanjing 210042, China*
- b. School of Chemistry and Chemical Engineering, Yangzhou University, Yangzhou 225002, China*
- c. Co-Innovation Center of Efficient Processing and Utilization of Forest Resources, Nanjing Forestry University, Nanjing 210037, China*
- d. Illinois Sustainable Technology Center, Prairie Research Institute, one Hazelwood Dr., Champaign, University of Illinois at Urbana-Champaign, IL 61820, USA*

* Corresponding Author: E-mail: zmhzyk19871120@163.com (Minghao Zhou)
jiangjc@icifp.cn (Jianchun Jiang)

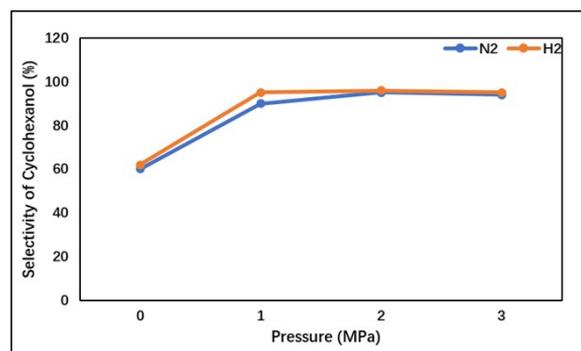


Fig. S1 Selectivity of cyclohexanol over different gas, reaction condition: (15+5)% NiCo/CNT catalyst, P = 2 MPa, T = 220 °C, t=2 h

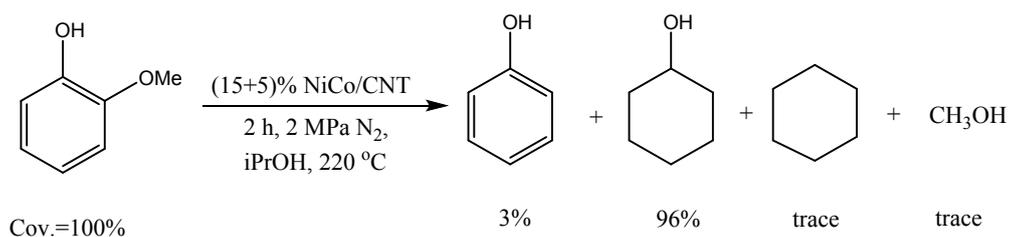


Fig. S2 Mass balance of the hydrogenation of guaiacol under the optimal reaction condition

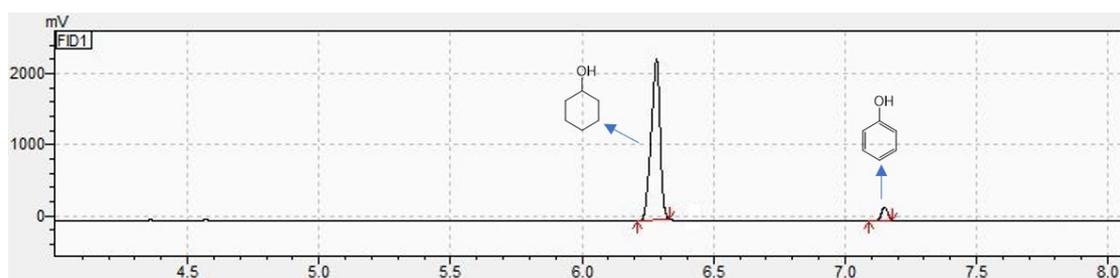


Fig. S3 Chromatogram of the hydrogenation of guaiacol under the optimal reaction condition

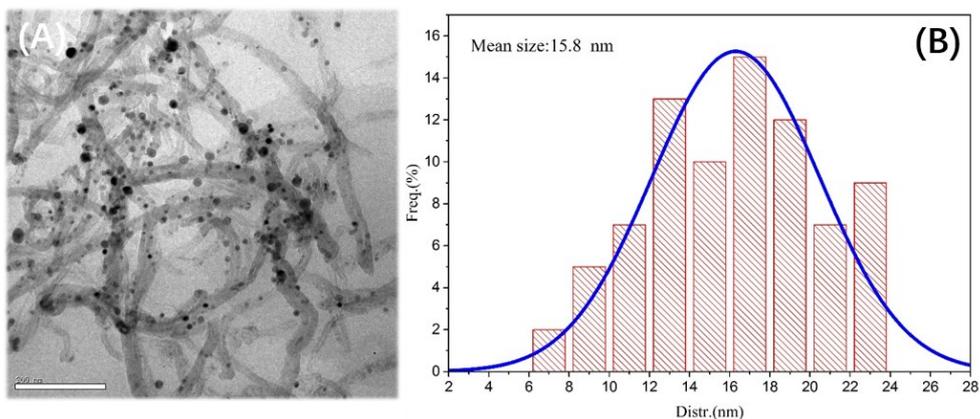


Fig. S4 TEM micrographs of 20% Ni/CNT prepared by ultrasound

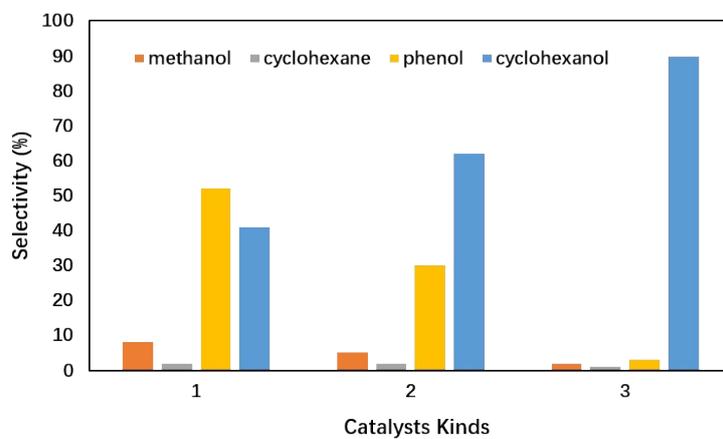


Fig. S5 Guaiacol conversion and products distribution over catalysts with different particle sizes
 Reaction condition: T = 220 °C, p = 2 MPa, t = 2 h; catalyst: 1-20% Ni/CNT (mean size=17.8 nm),
 2-20% Ni/CNT (mean size =15.8 nm), 3-(15+5)% NiCo/CNT (mean size =13.1 nm)

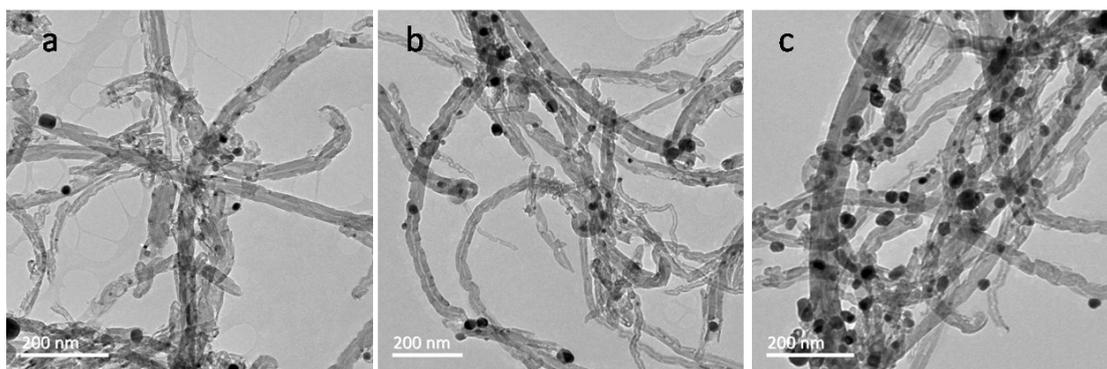


Fig. S6 TEM micrographs of (7.5+2.5)% Ni/CNT (a), (15+5)% Ni/CNT (b) and (22.5+7.5)% Ni/CNT (c)

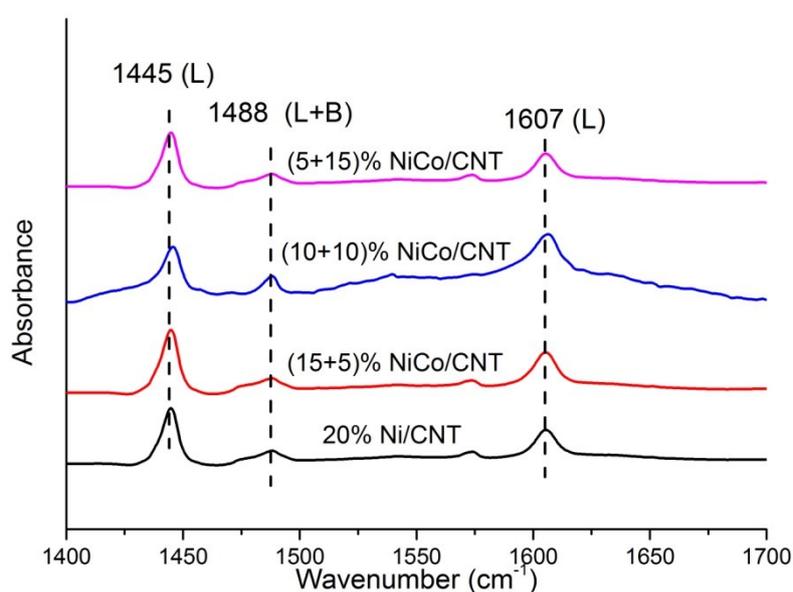


Fig. S7 Py-IR of 20% Ni/CNT and different ratios NiCo/CNT catalysts

Table S1 Bronsted acid and Lewis acid distribution in Ni/CNT and bimetallic NiCo/CNT catalysts

| | 20%Ni/CNT | (15+5)% NiCo/CNT | (10+10)% NiCo/CNT | (5+15)% NiCo/CNT |
|---------------------------------------|-----------|---------------------|----------------------|---------------------|
| B acid sites ($\mu\text{mol/g}$) | 2.9 | 14.1 | 14.9 | 17.0 |
| L acid sites ($\mu\text{mol/g}$) | 177.2 | 217.8 | 203.6 | 200.4 |
| Total acid ($\mu\text{mol/g}$) | 180.1 | 231.9 | 218.5 | 217.4 |
| B/L ratio | 0.016 | 0.065 | 0.073 | 0.085 |