Electronic Supplementary Information (ESI) for

Sodium Borohydride-Nickel Chloride Hexahydrate in EtOH/PEG-400 as an Efficient and Recyclable Catalytic System for the Reduction of Alkenes

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1. Materials and analyses

NiCl₂·6H₂O, PEG-400 were purchased from Alfa Aesar. Alkenes and solvents were from Aladdin. Unless otherwise noted, all chemicals were analytical reagents without further purification. UV-vis measurement was acquired using a UV/Vis spectrophotometer. The HRTEM image was taken with a JEM2100F TEM at an accelerating voltage of 200 kV. XPS analysis was performed on a Thermo VG ESCALAB 250 Microprobe instrument using Al Kα radiation as the X-ray source. The binding energy of the element was calibrated using a C 1s photoelectron peak at 284.6 eV. ICP-AES analyses of Ni leaching were carried out on Optima 2000DV (Thermo Elemental, USA). GC analyses were performed on Persee GC1100 instrument equipped with a 50 m × 0.25 mm OV-101 column and a FID detector. GC-MS were acquired using Persee MT-80EI with a 50 m × 0.25 mm HP-5MS column (He as a carrier gas).

2 General procedures for the reduction of alkenes catalyzed by in situ generated Ni NPs

In a typical experiment, a solution of alkene (5 mmol) and NiCl₂·6H₂O (0.25 mmol) in the mixture of anhydrous ethanol and PEG-400 (5 mL, volume ratio 3:2) was added NaBH₄ (95 mg, 2.5 mmol) under N₂ atmosphere, the flask was immediately sealed and stirred at 30 °C for a certain time. After reaction, the result mixture was extracted with 5 mL n-heptane or...
petroleum ether. The upper phase was separated by decantation and analyzed by GC and GC-MS.

3 Procedure for the reduction of styrene catalyzed by preformed Ni NPs

NiCl₂·6H₂O (0.25 mmol) was dissolved in the mixture of anhydrous ethanol and PEG-400 (5 mL, volume ratio 3:2) under N₂ atmosphere, NaBH₄ was added (10 mg, 0.26 mmol) and then the color of solution turned to black immediately, suggesting the formation of Ni nanoparticles. Styrene (5 mmol) and NaBH₄ (85 mg, 2.24 mmol) were added to the reaction mixture. The flask was immediately sealed and stirred at 30 °C for a certain time. After reaction, the result mixture was extracted with 5 mL n-heptane, and the yield of ethylbenzene was determined by GC and GC-MS analysis.

4 GC-MS data for hydrogenated products

Ethylbenzene(C₈H₁₀), tᵣ = 8.119 min
Molecular Weight: 106.16
1- Hexane ($C_6H_{14}$), $t_r = 4.940$ min
Molecular Weight: 86.18

1-Octane ($C_8H_{18}$), $t_r = 6.916$ min
Molecular Weight: 114.23
Decane (C\textsubscript{10}H\textsubscript{22}), \ t_r = 8.957 \text{ min} 
Molecular Weight: 142.29

\textit{n}-Dodecane(C\textsubscript{12}H\textsubscript{26}), \ t_r = 10.590 \text{ min} 
Molecular Weight: 170.33
$\rho$-Ethyltoluene ($C_{12}H_{16}$), $t_r = 10.174\text{min}$
Molecular Weight: 120.19
Norbornane(C$_7$H$_{12}$), $t_r = 6.633\text{min}$
Molecular Weight: 96.17

Phenyl propyl ether(C$_9$H$_{12}$O), $t_r = 10.326\text{min}$
Molecular Weight: 136.19
p-Propyl anisole ($C_{10}H_{14}O$), $t_r = 11.286$ min
Molecular Weight: 150.24

Cyclohexane ($C_6H_{12}$), $t_r = 5.597$ min
Molecular Weight: 84.16
Pinane (C_{10}H_{18}), t_r = 12.012 min (product from reduction of α-pinene)
Molecular Weight: 138.25
Cyclooctene ($C_8H_{14}$), $t_r = 8.284\text{min}$, Molecular Weight: 110.20

Cyclooctane ($C_8H_{16}$), $t_r = 8.415\text{min}$, Molecular Weight: 112.20

Cyclopentane ($C_5H_{10}$), $t_r = 4.809\text{min}$
Molecular Weight: 70.13
