

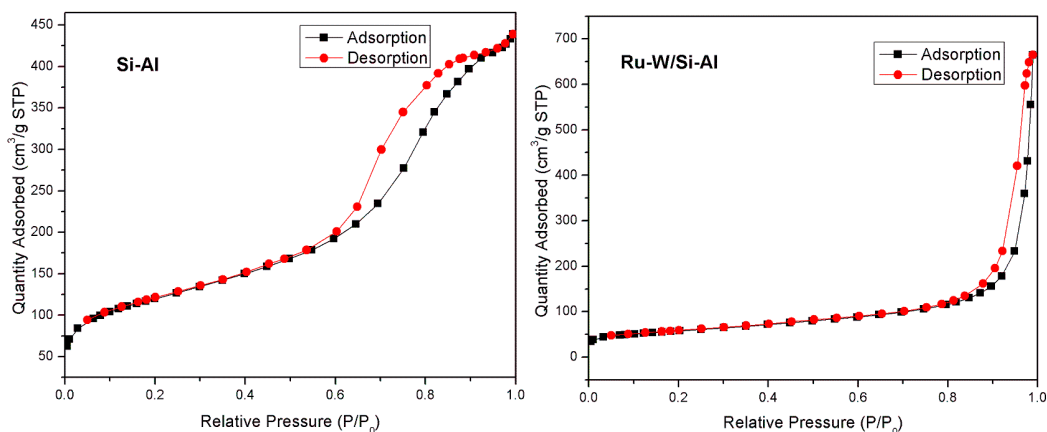
## Selective Hydrogenolysis of Phenols and Phenyl Ethers to Arenes through Direct C-O Cleavage over Ruthenium-Tungsten Bifunctional Catalysts.

### Supporting Information

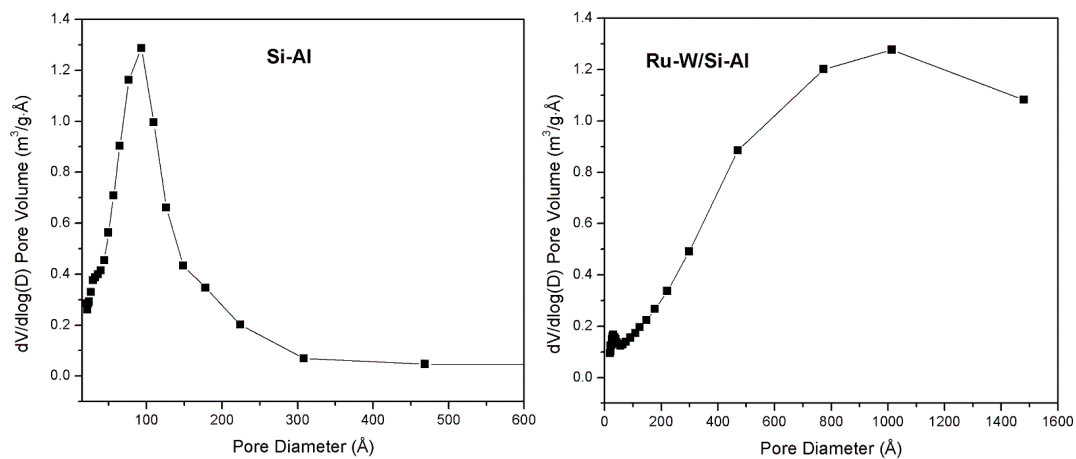
#### 1. Characterization of the catalysts

**Table S1.** BET analysis of several catalysts.

entry	catalyst	$S_{\text{BET}}$ ( $\text{m}^2/\text{g}$ )	$D_p$ ( $\text{\AA}$ )	$V_p$ ( $\text{cm}^3/\text{g}$ )
1	SiAl	429.5	60.93	0.654
2	5Ru-30W/SiAl	202.5	109.8	0.556



**Figure S1.**  $\text{N}_2$  adsorption isotherms for SiAl and Ru-W/SiAl



**Figure S2.** BJH pore size distributions for SiAl and Ru-W/SiAl

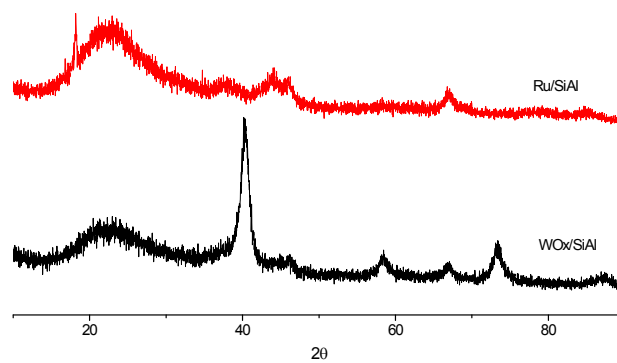
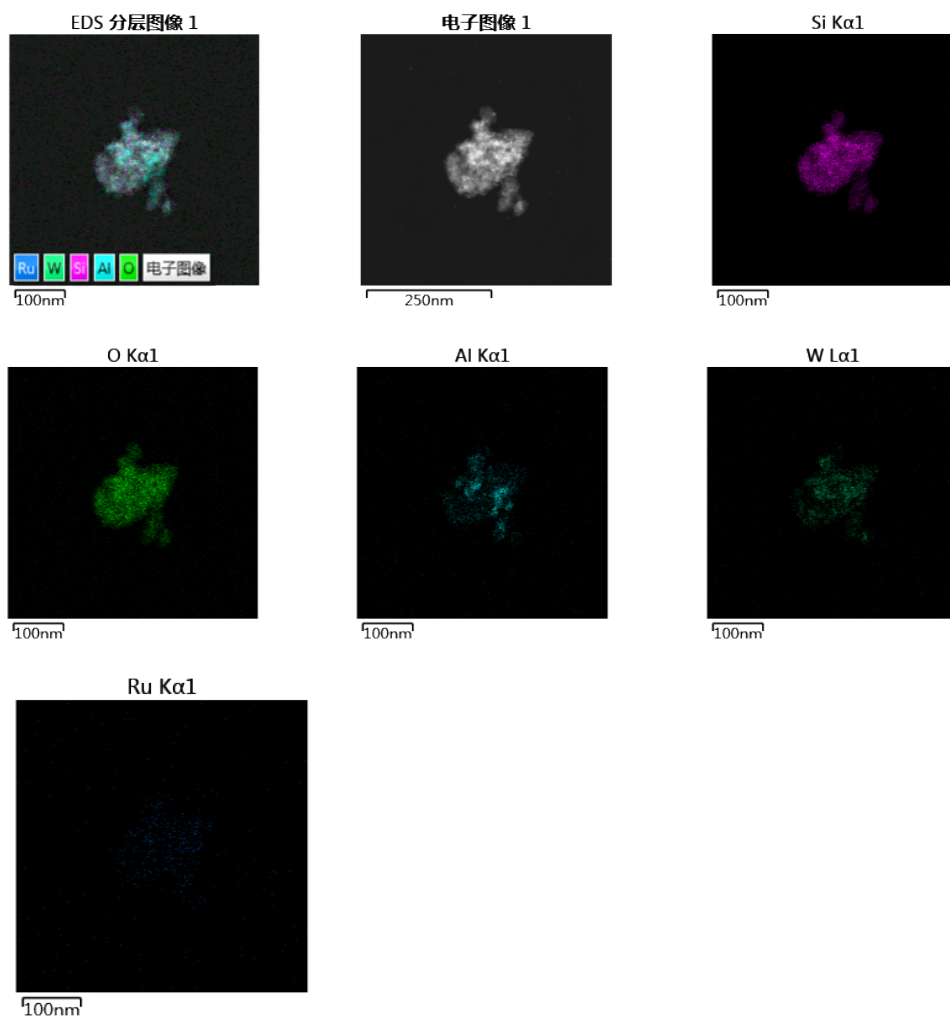


Figure S3. XRD of the Ru/SiAl and WO<sub>x</sub>/ SiAl catalyst

### STEM- Elemental Mapping



Scheme S1. Elemental Mapping of the Ru-W/SiAl catalyst.

## 2. Experimental section

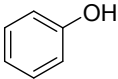
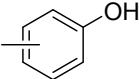
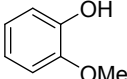
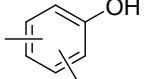
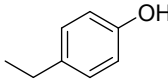
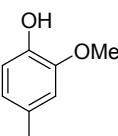
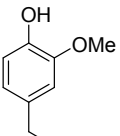
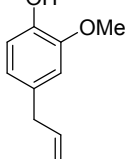
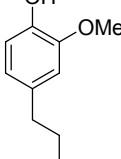
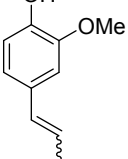
### Indification of phenols separated from pyrolysis lignin

The phenols extracted from the pyrolysis of rice husk were subjected to the qualitative and quantitative analysis by GC-MS and GC.

*GC-MS spectra of phenols:*

**Figure S4.** GC-MS analysis of phenols from pyrolysis lignin.

**Table S2.** The main phenols separated from the pyrolysis lignin. (The total mixture was 100 mg)

<b>Aromatics</b>					
Content/mg	3.66	10.38	10.54	4.08	18.94
<b>Aromatics</b>					
Content/mg	6.06	6.62	6.41	2.56	3.15

The mixture was analyzed by GC and the contents were calculated by adding the internal standard.



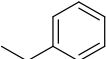
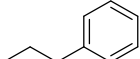


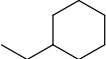
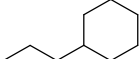
Total detected aromatics: 72.4 mg.

The other unknown products 27.6 mg

Total detected aromatics yield:

$$\frac{\text{total detected aromatics}}{\text{The mixture from the extracted bio-oil}} = \frac{72.4 \text{ mg}}{100 \text{ mg}} = 72.4 \%$$

**Table S3.** The main arene products from the hydrogenolysis of phenols. (Calculated as the starting phenols 100 mg)

<b>Aromatics</b>					total arenes
Content/mg	6.05	7.13	10.05	4.06	27.29
<b>Cyclo-alknes</b>					total cyclo-alknes
Content/mg	0.93	0.87	1.13	0.76	3.69

Other by products and the unreacted phenols were sum up to ~5.43 mg. The total weight of the detected molecules (crude products) after the reaction was ~36.41 mg.

The crude products yield after the hydrogenolysis reactions was:

$$\frac{\text{Crude products}}{\text{Starting phenols}} \times 100\% = \frac{36.41\text{mg}}{100\text{ mg}} = 36.4\%$$

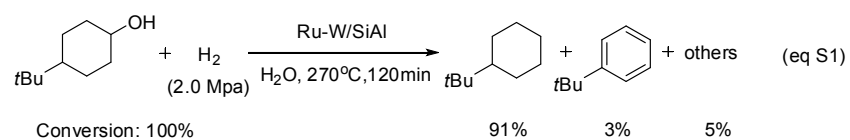
Selectivities of the arenes, cycloalkanes and others in the final mixture (crude products) after the hydrogenolysis reaction:

$$\text{Arenes selectivity} = \frac{\text{Arenes}}{\text{Crude products}} \times 100\% = \frac{27.29\text{ mg}}{36.41\text{ mg}} = 74.9\%$$

$$\text{Cycloalkanes selectivity} = \frac{\text{Cycloalkanes}}{\text{Crude products}} \times 100\% = \frac{3.69\text{ mg}}{36.41\text{ mg}} = 10.1\%$$

$$\text{Others selectivity} = 1 - (74.9\% + 10.1\%) = 15\%$$

**Figure S5.** GC-MS analysis of reactions mixture at different reaction times.



**Scheme S2.** Hydrogenolysis of the ring hydrogenation intermediate over Ru-W catalyst.