

Supporting Information for

Partial hydrogenation of benzene to cyclohexene on Ru@XO₂ (X=Ti, Zr or Si)

Xue-Lian Yu ^a, Yan Li ^b, Shuang-Mei Xin ^a, Pei-Qing Yuan ^{a*}, Wei-Kang Yuan ^a

^a State Key Laboratory of Chemical Engineering, East China University of Science
and Technology, Shanghai 200237, China

^b School of Chemistry and Molecular Engineering, East China University of Science
and Technology, Shanghai 200237, China

*Corresponding author.

Pei-Qing Yuan

State Key Laboratory of Chemical Engineering

East China University of Science and Technology

130 Meilong Road

Shanghai, 200237

People's Republic of China

Tel.: +862164253529; fax: +862164253528.

E-mail address: pqyuan@ecust.edu.cn (P.Q. Yuan).

ORCID: 0000-0003-0797-963X

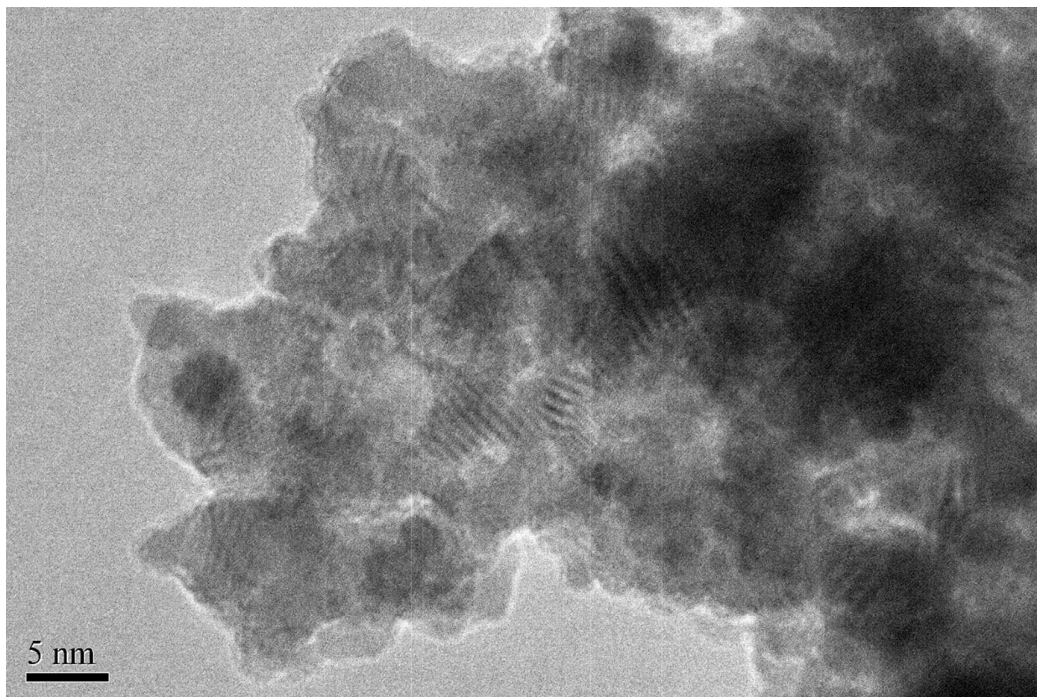


Figure S1. HRTEM image of Ru particles.

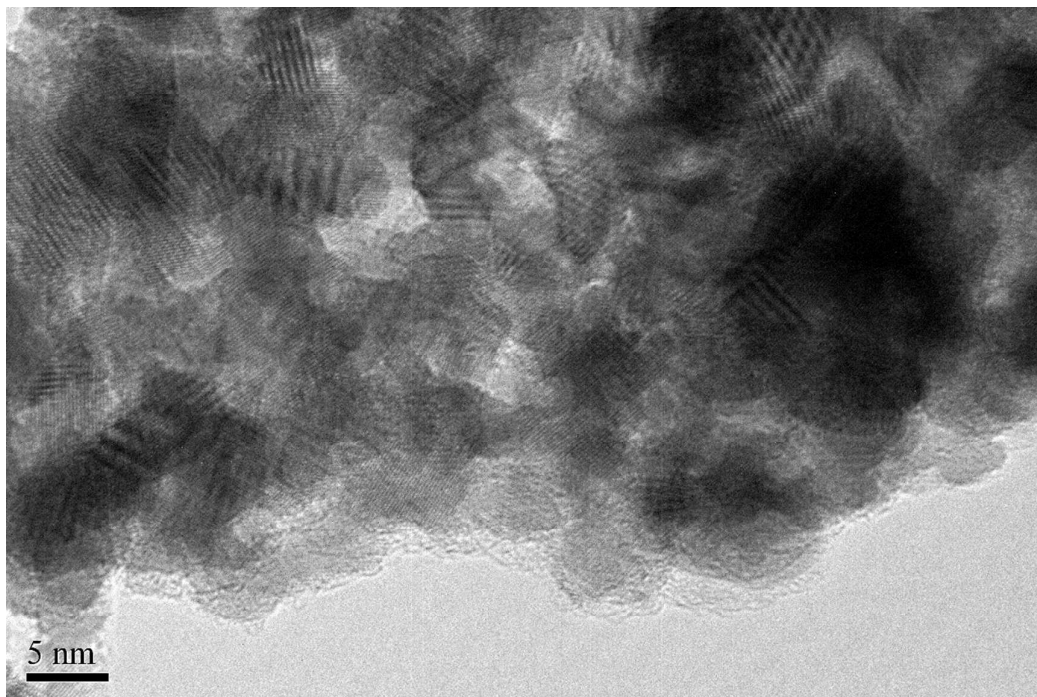


Figure S2. HRTEM image of Ru@TiO₂.

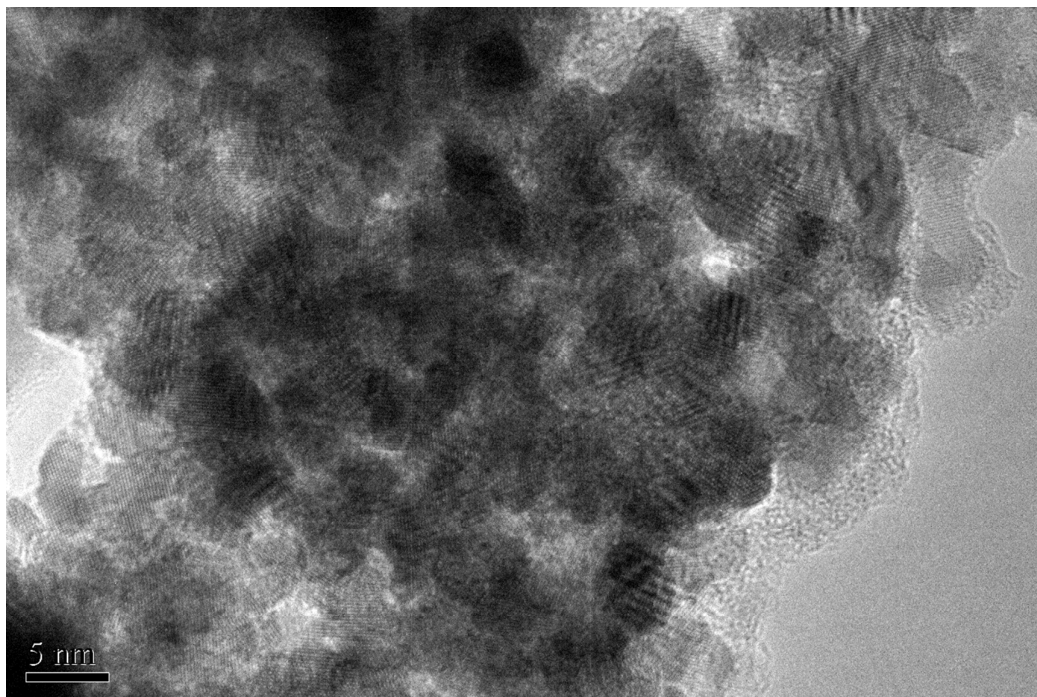


Figure S3. HRTEM image of Ru@ZrO₂.

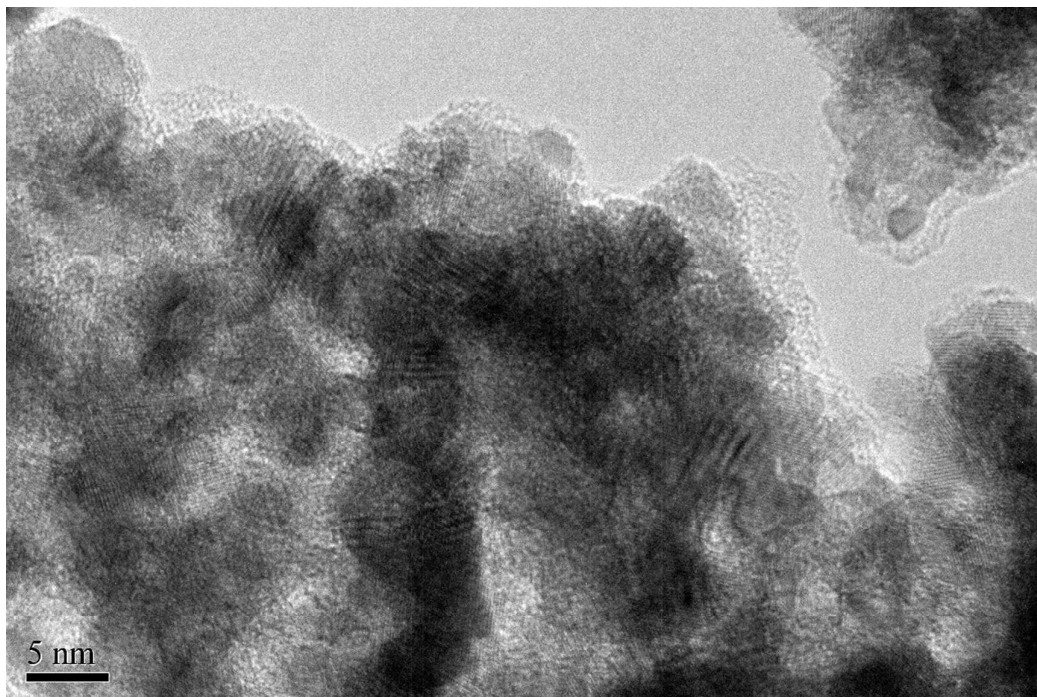


Figure S4. HRTEM image of Ru@SiO₂.

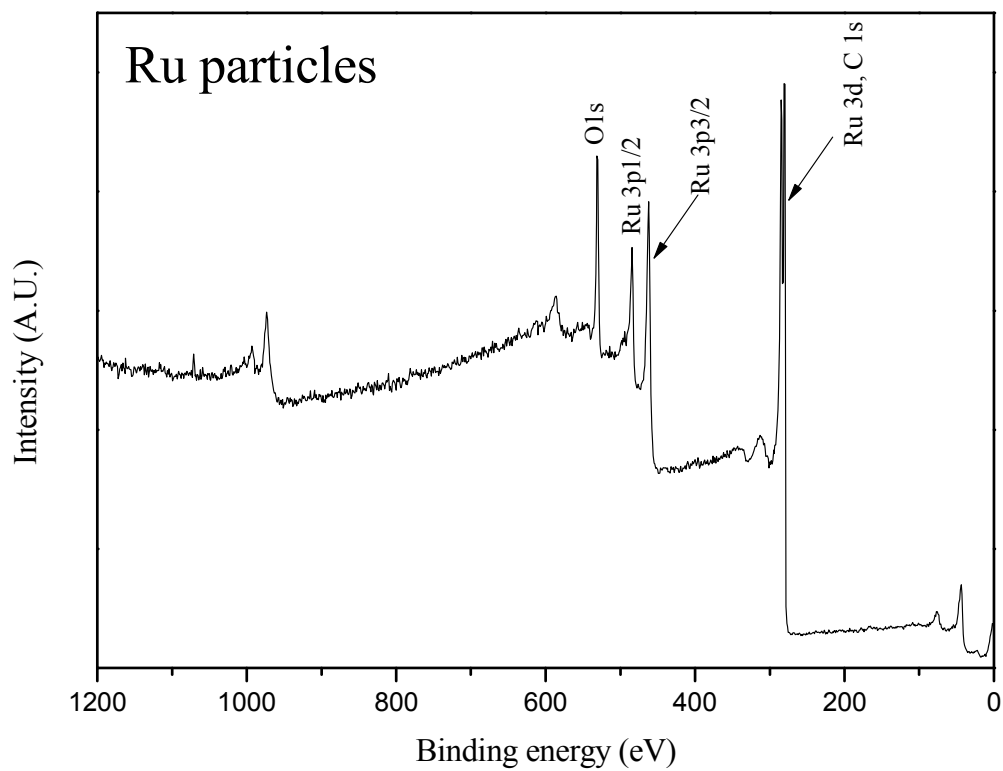


Figure S5. XPS spectrum of Ru particles.

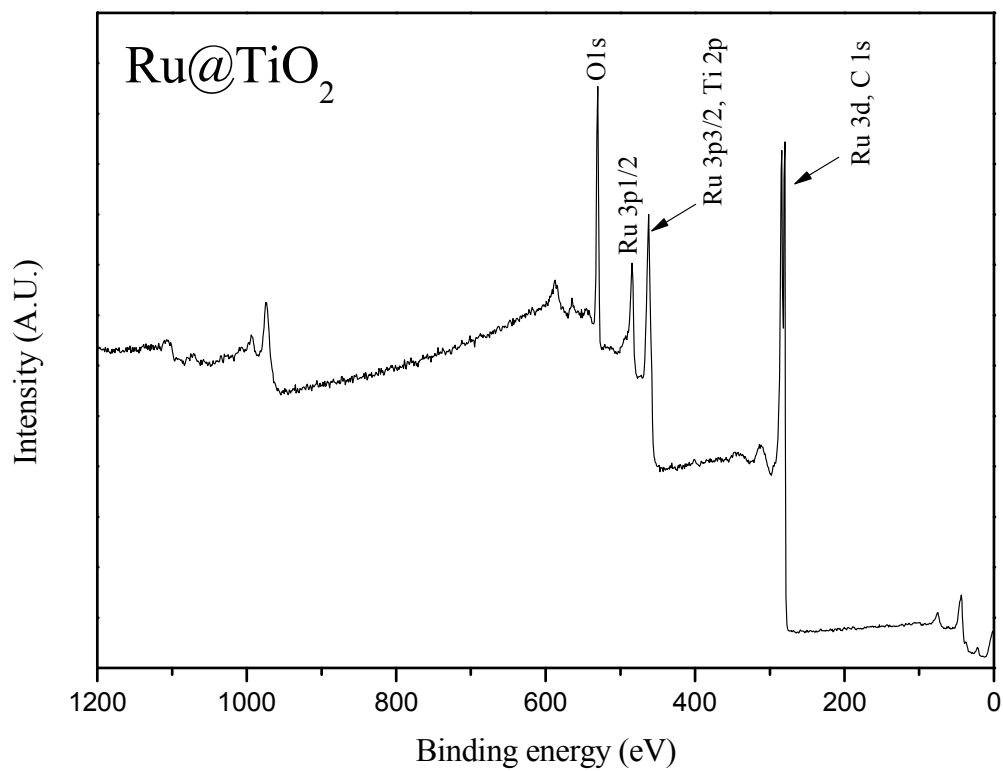


Figure S6. XPS spectrum of Ru@TiO₂.

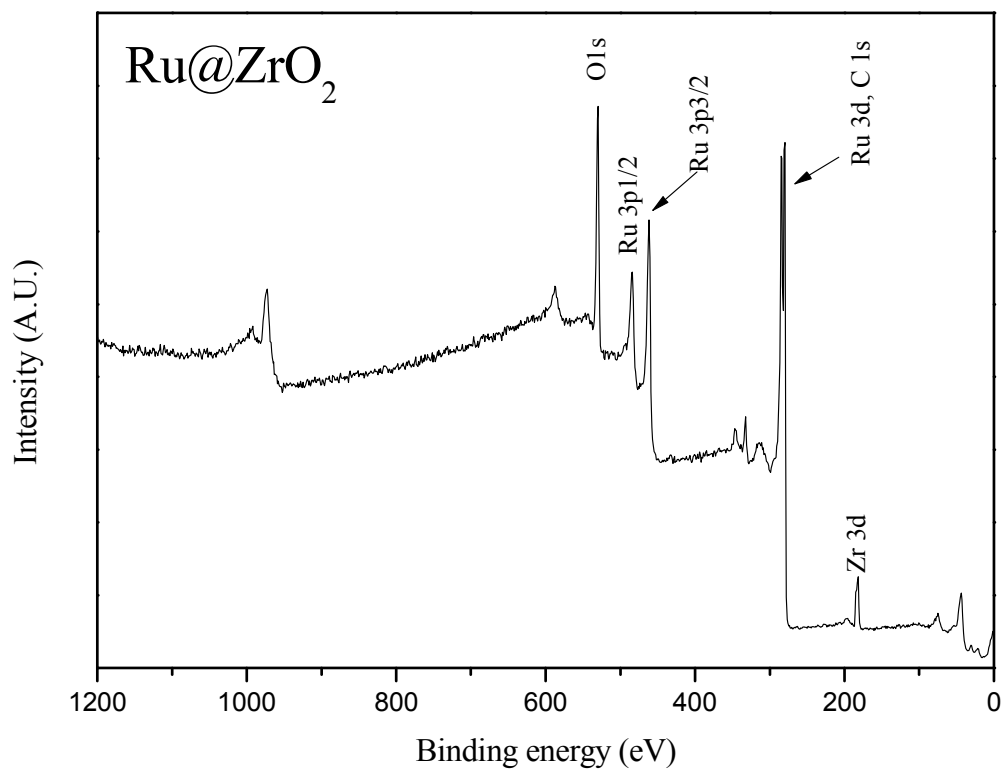


Figure S7. XPS spectrum of Ru@ZrO₂.

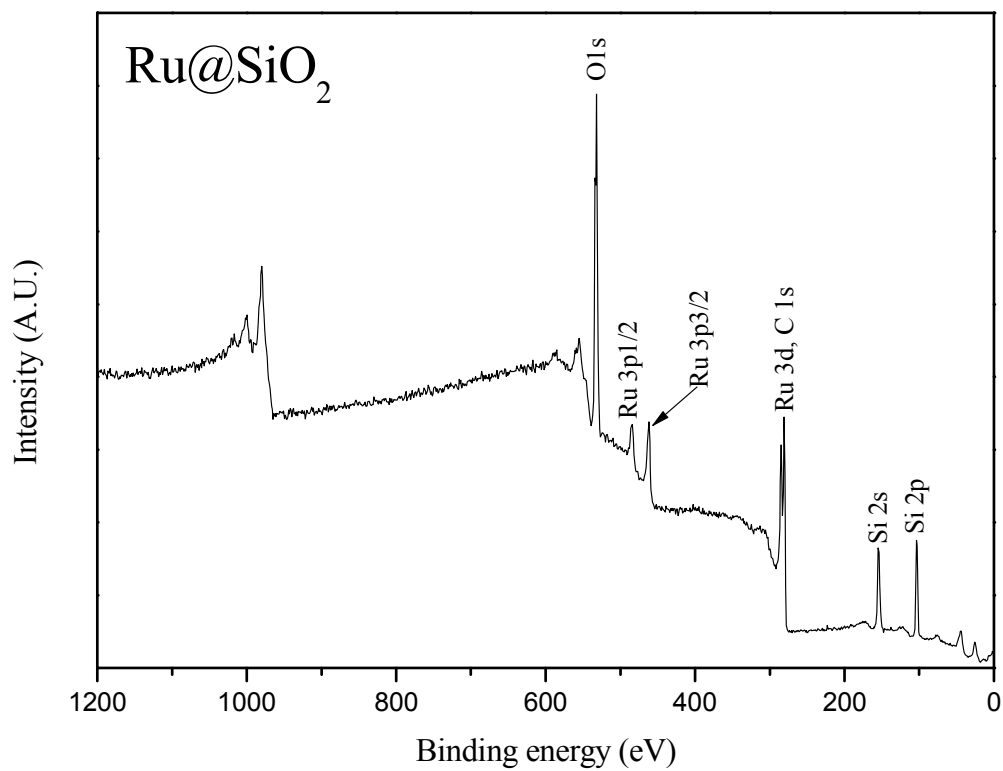


Figure S8. XPS spectrum of Ru@SiO_2 .

Table S1. Characteristic binding energies of Ti, Zr and Si elements in corresponding oxides

binding energy (eV) ^a	
Ti 2p	458.3-458.7
Zr 3d	182.3
Si 2s, Si 2p	154.6, 103.6

^a Retrieved from NIST X-ray photoelectron spectroscopy database at <https://srdata.nist.gov/xps/Default.aspx>

Table S2. Performance of Ru@XO₂ (X=Ti, Zr or Si) under Asahi conditions(Temperature of 150°C and H₂ partial pressure of 6.0 MPa)

catalysts	reaction time	conversion of	selectivity of	yield of
	(min)	benzene (%)	cyclohexene (%)	cyclohexene (mol%)
Ru particles	15	92.1	23.8	23.3
Ru@TiO ₂	15	83.2	57.0	47.5
Ru@ZrO ₂	15	80.8	57.3	46.3
Ru@SiO ₂	15	75.0	54.2	40.6