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Supplementary data

Mesoporous Zr-SBA-15 as green solid acid catalyst for Prins reaction

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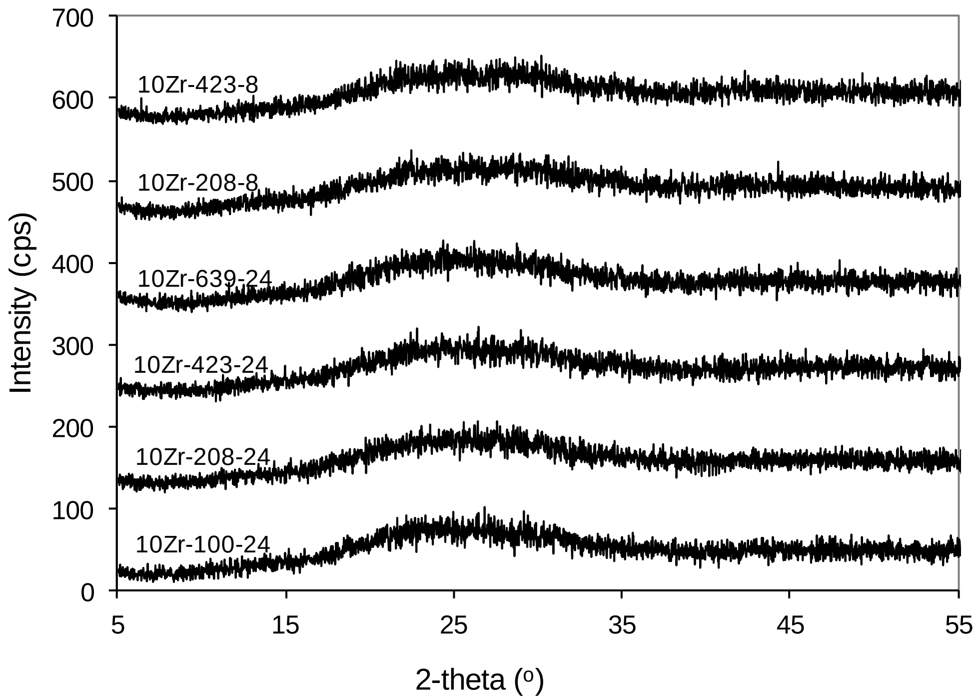
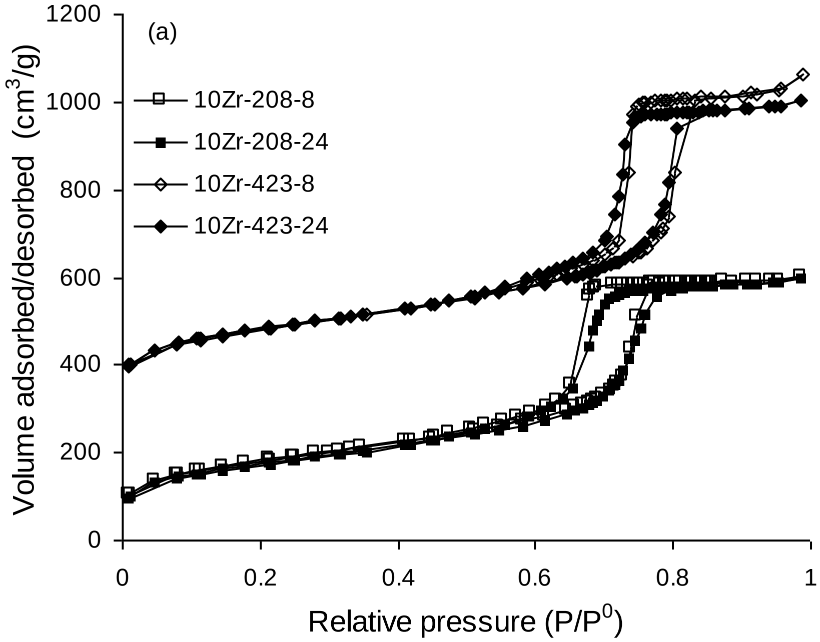


Fig. S1. Wide-angle XRD patterns of 10Zr-SBA samples (a) 10Zr-100-24 (b) 10Zr-208-24 (c) 10Zr-423-24 (d) 10Zr-639-24 (e) 10Zr-208-8 and (f) 10Zr-423-8.



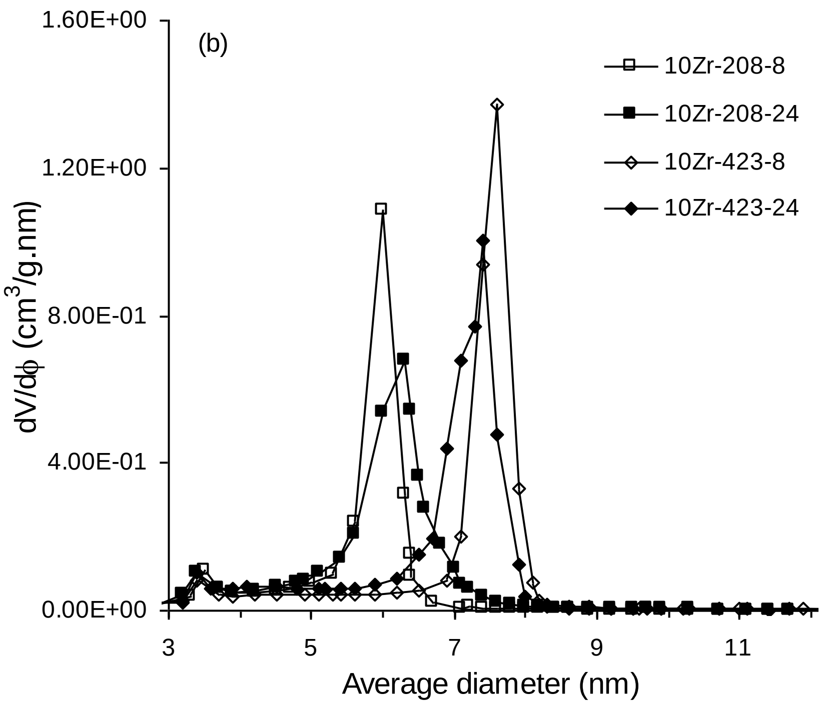


Fig. S2. (a) N_2 adsorption–desorption isotherms and (b) pore size distribution of calcined 10Zr–208 and 10Zr-423 formed with 8 and 24 h aging time. Isotherms of 10Zr-423-8 and 10Zr-423-24 offset by 300 cm^3/g.

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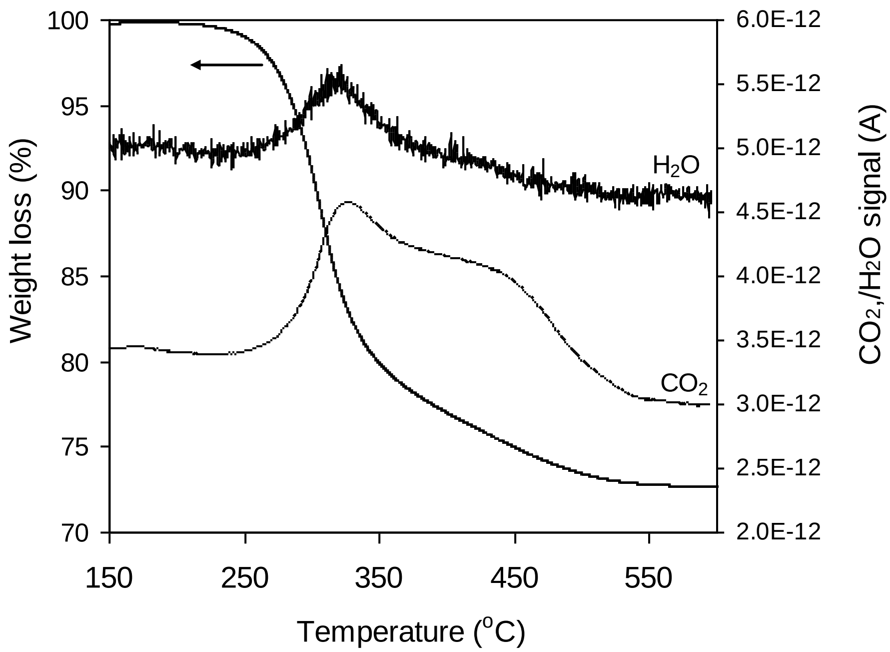

Fig. S3. TGA-MS of uncalcined 10Zr-100-24.

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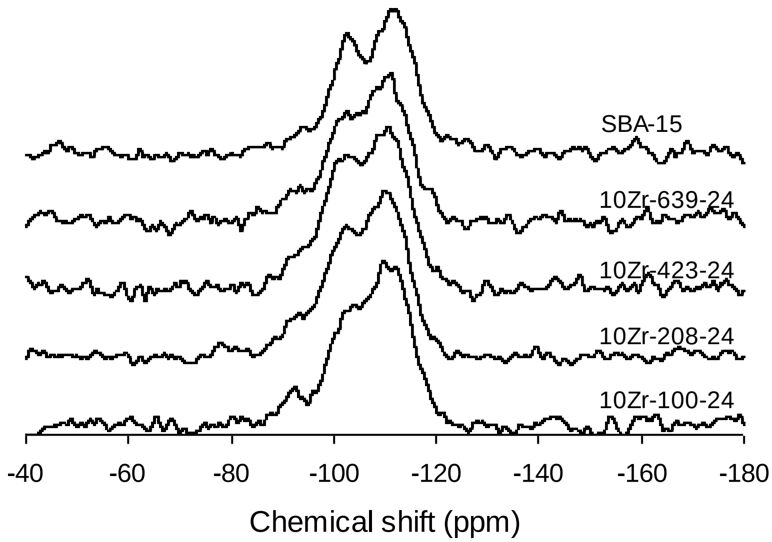

Fig. S4. ^{29}Si NMR of Si-SBA-15 and 10Zr-SBA-15 samples.

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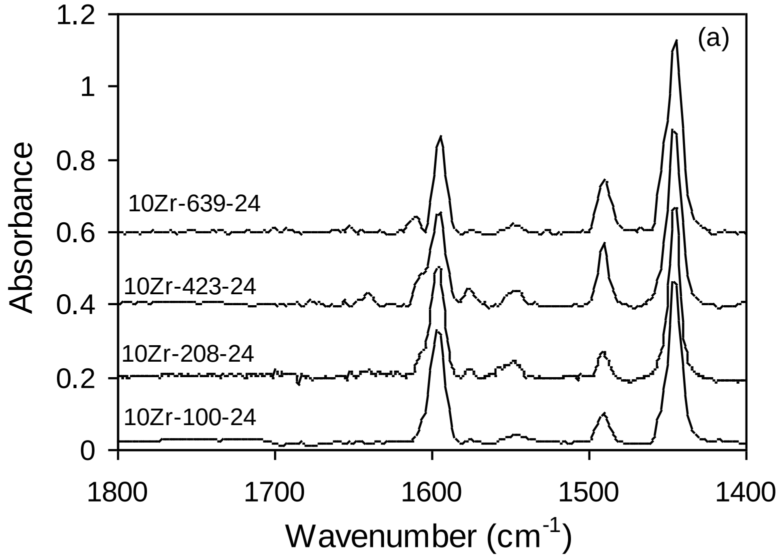

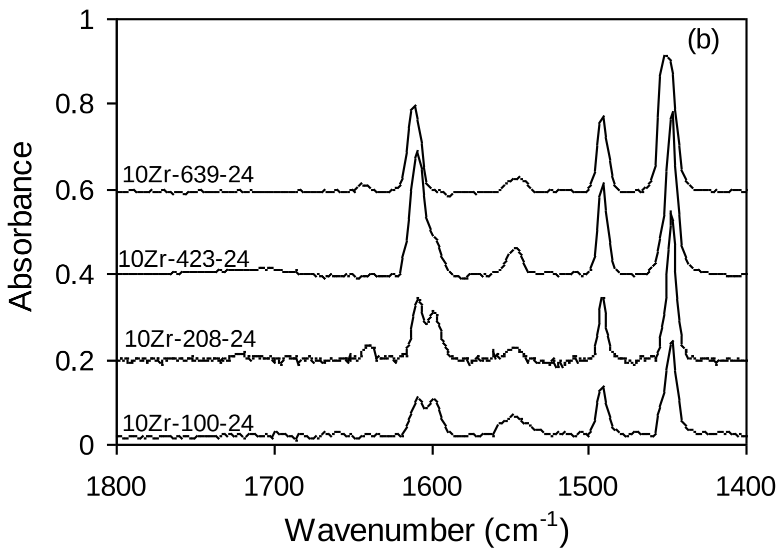

Fig. S5. Pyridine IR of 10Zr-SBA samples after pyridine adsorption followed by evacuation for 1 h at (a) room temperature and (b) 100 °C.

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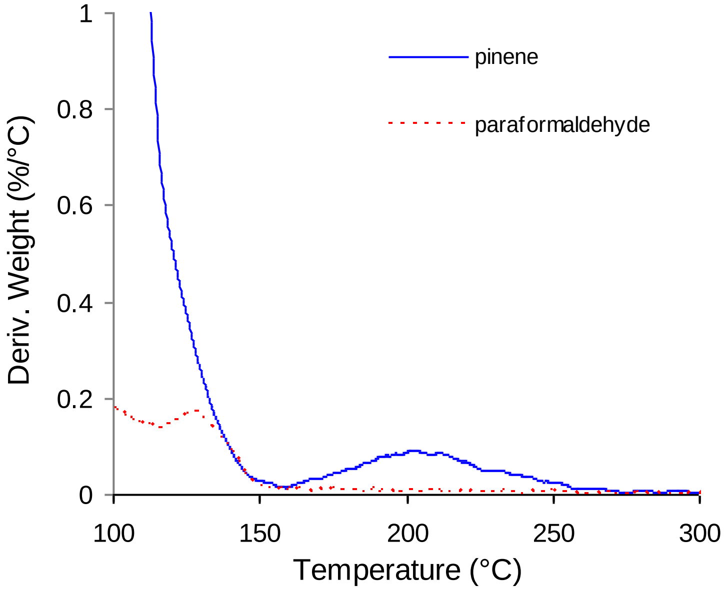

Fig. S6. Derivative weight loss versus temperature for β-pinene and formaldehyde adsorbed on 10Zr-423-8. Heat ramp at 10 °C min^{-1} from room temperature to 500 °C in N_2. Displayed curve is after subtraction from blank run of 10Zr-423-8.

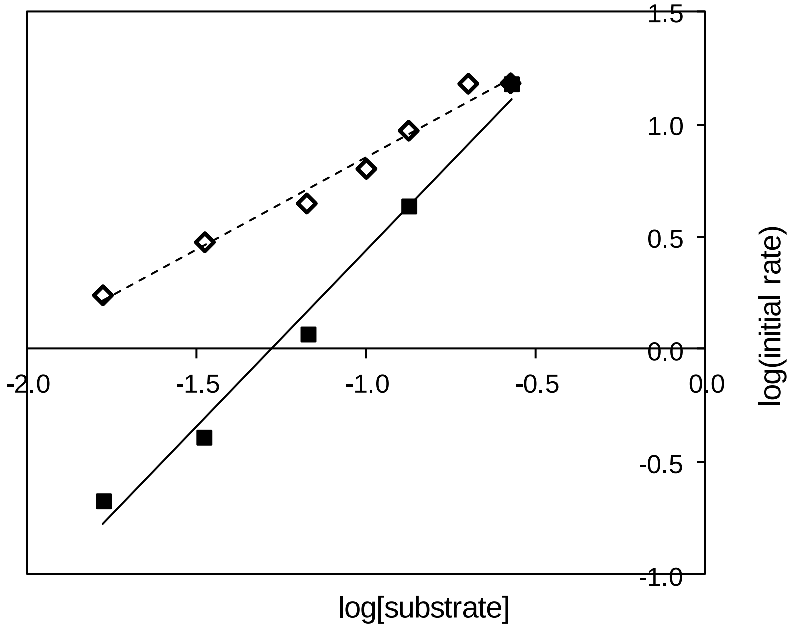

Fig. S7. Dependence of rate on concentration of (◇) β-pinene and (■) formaldehyde on 10Zr-423-8.

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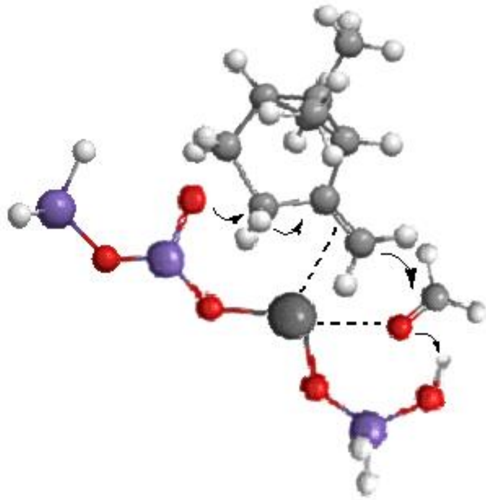

Fig. S8. Proposed coordination of β-pinene and formaldehyde at a zirconium site (dark grey sphere) leading to Nopol formation.

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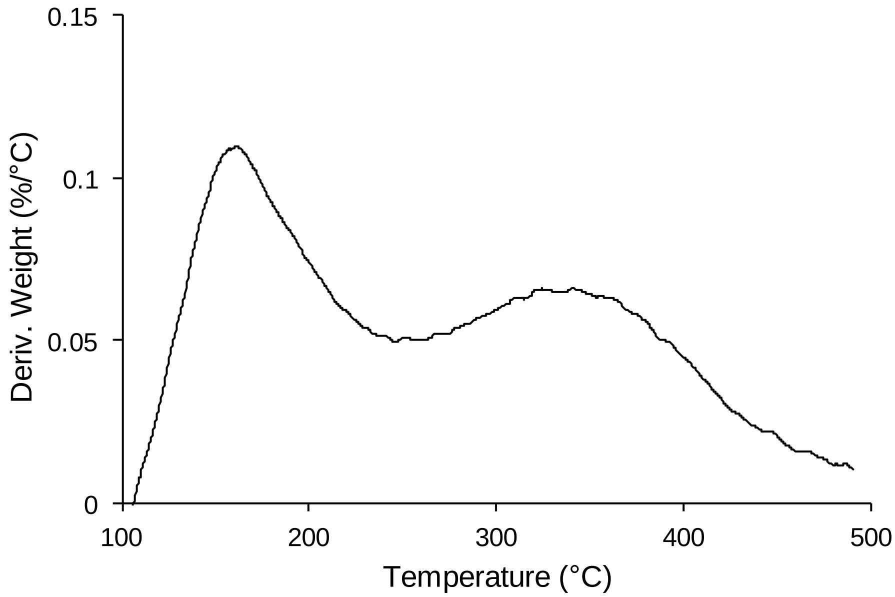

Fig. S9. Derivative weight loss versus temperature for 10Zr-423-8 after reaction, washing twice with 5 ml toluene and drying in N_2. Heat ramp at 10 °C min^{-1} from room temperature to 500 °C in N_2. Displayed curve is after subtraction from blank run of 10Zr-423-8.