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# Catalytic behaviour of $TiO_2$–$ZrO_2$ binary oxide synthesized by sol-gel process for glucose conversion to 5-hydroxymethylfurfural

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Table S1 Comparison of fructose and glucose conversion to HMF[a]

| Entry | Samples | Substrate | Conv. (%) | Yield (%) | |
|---|---|---|---|---|---|
| | | | | HMF | Levulinic acid |
| 1 | $TiO_2$ | Fructose[b] | 95.3 | 24.1 | 1.24 |
| | | Glucose | 86.0 | 16.1 | 2.46 |
| 2 | $ZrO_2$ | Fructose[b] | 85.6 | 29.6 | 0.31 |
| | | Glucose | 72.2 | 22.9 | 0.93 |

[a]Reaction conditions: 2 g substrate, 100 ml water, 0.8 g catalyst wt., 3 h reaction time, 175 °C temperature. [b]160 °C temperature, 5 h reaction time.

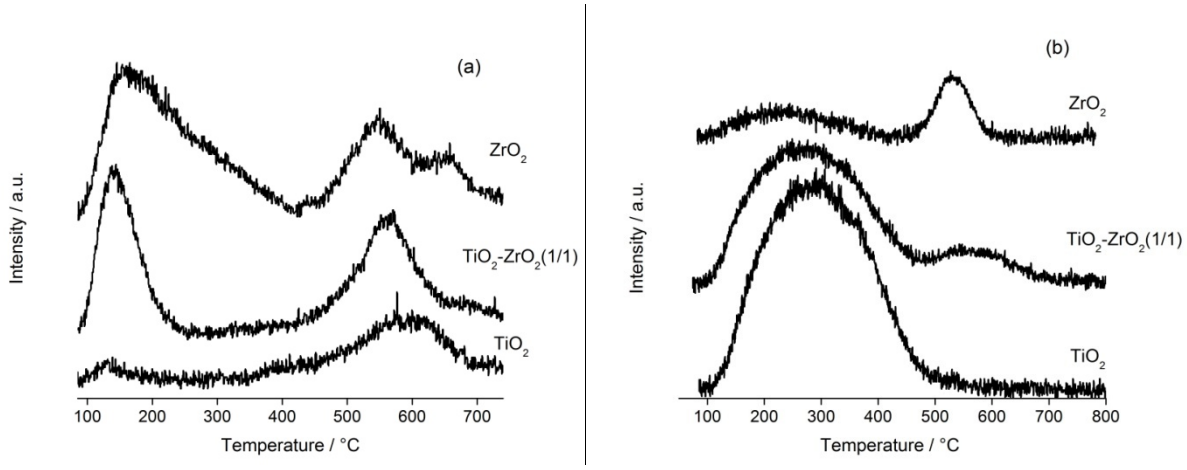


Fig. S1 a) $CO_2$ and b) Ammonia temperature programmed desorption profiles of the metal oxides.

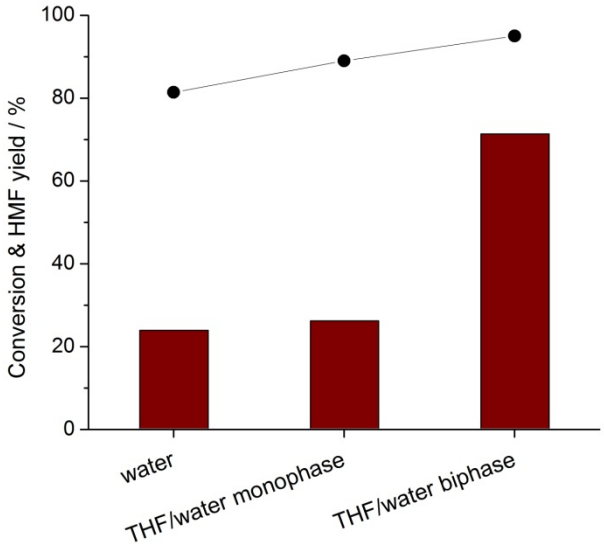


Fig. S2 Role of reaction medium on glucose conversion to HMF catalyzed by $TiO_2$–$ZrO_2$ (1/1). Reaction conditions: 2 g glucose, 0.8 g catalyst wt., 100 ml solvent, 4 g NaCl, 3 h reaction time, reaction temperature 175 °C.

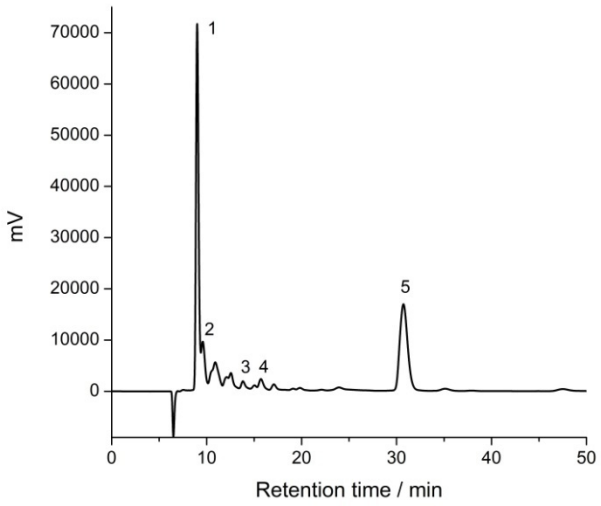


Fig. S3 HPLC analytical profile measured using RID detector for glucose to HMF reaction using $TiO_2$–$ZrO_2$ (1/1) in aqueous reaction medium. Reaction conditions: 2 g glucose, 0.8 g catalyst wt., 100 ml solvent, 3 h reaction time, reaction temperature 175 °C. 1) glucose, 2) fructose, 3) formic acid, 4) levulinic acid and 5) 5-hydroxymethyfurfural

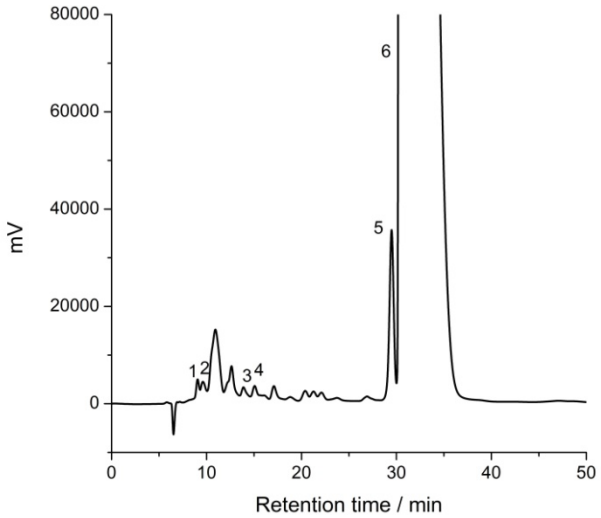


Fig. S4 HPLC analytical profile measured using RID detector for glucose to HMF reaction using $TiO_2$–$ZrO_2$ (1/1) in water/THF monophase reaction medium. Reaction conditions: 2 g glucose, 0.8 g catalyst wt., 100 ml solvent (water/THF = 1/4 v/v), 3 h reaction time, reaction temperature 175 °C. 1) glucose, 2) fructose, 3) formic acid, 4) levulinic acid, 5) 5-hydroxymethyfurfural and 6) tetrahydrofuran

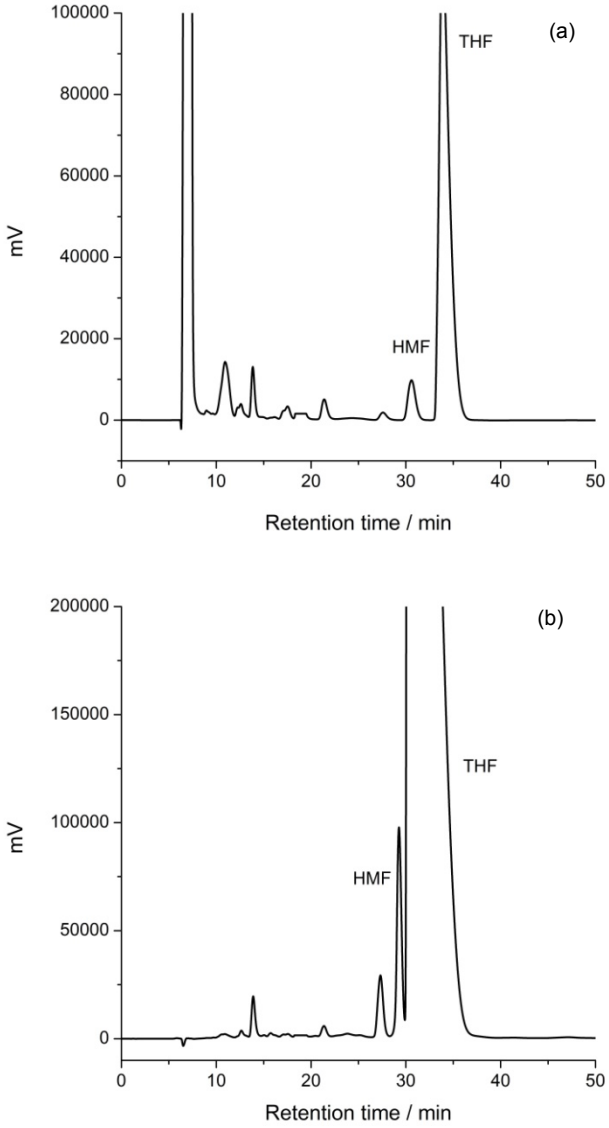


Fig. S5 HPLC analytical profile measured using RID detector for glucose to HMF reaction using $TiO_2$–$ZrO_2$ (1/1) in water/THF biphase reaction medium. Reaction conditions: 2 g glucose, 0.8 g catalyst wt., 100 ml solvent (THF/water = 4/1 v/v), 4 g NaCl, 3 h reaction time, reaction temperature 175 °C. a) aqueous phase and b) organic phase.

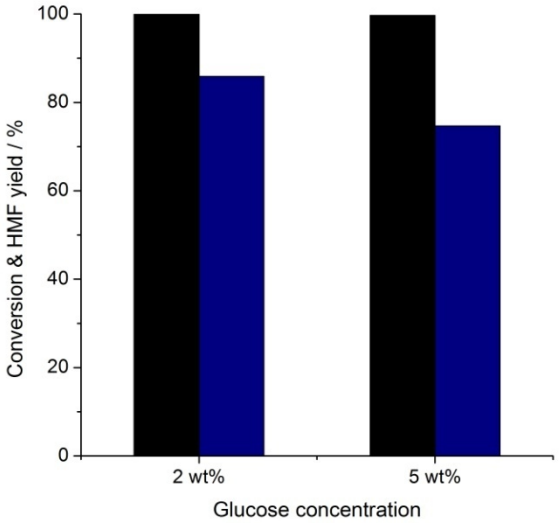


Fig. S6 Influence of initial glucose concentration on HMF yield. Reaction conditions: glucose/catalyst = 2.5 w/w, catalysts = $TiO_2$–$ZrO_2$ (1/1) and Amberlyst 70 (1/1 w/w), 100 ml solvent (THF/water = 4/1 v/v), 4 g NaCl, 3 h reaction time, 175 °C reaction temperature.