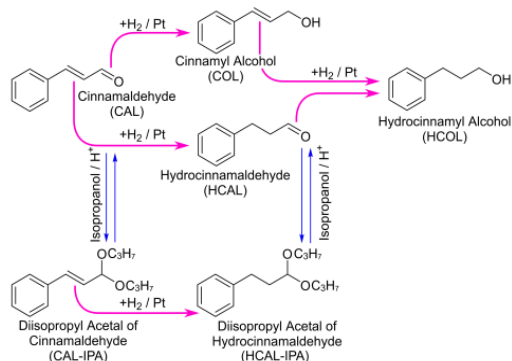
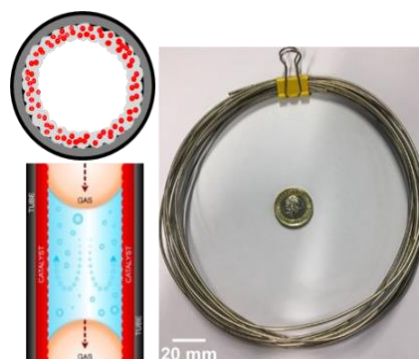


Highly Selective Continuous Flow Hydrogenation of Cinnamaldehyde to Cinnamyl Alcohol in a Pt/SiO₂ Coated Tube Reactor

A novel continuous flow process for selective hydrogenation of conjugated alkene aldehyde (cinnamaldehyde CAL) to the unsaturated alcohol (cinnamyl alcohol COL) (Scheme 1) has been reported over a Pt/SiO₂ coating in a tube reactor (Scheme 2).



Scheme 1. The main reaction routes and side reactions during the catalytic hydrogenation of cinnamaldehyde.



Scheme 2. The scheme of a typical the tube reactor coated with Pt/SiO₂ catalyst

Stoli reactor demonstrated superior parameters in comparison to batch, fixed bed reactors and reported in literature systems.

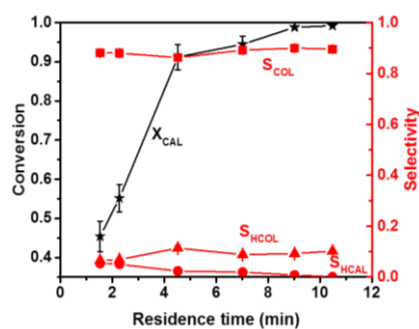


Figure 1. The influence of residence time on CAL conversion and COL selectivity in the tube reactor.

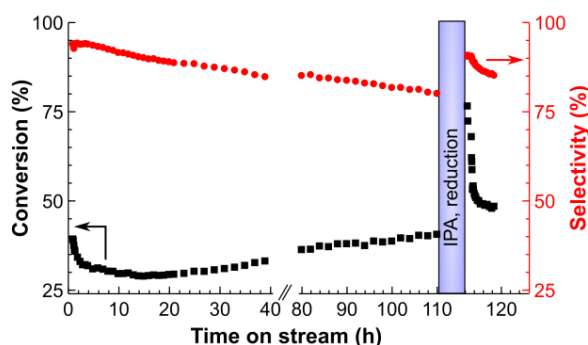


Figure 2. The stability test of the tube reactor coated with a 12 wt % Pt/SiO₂ catalyst.

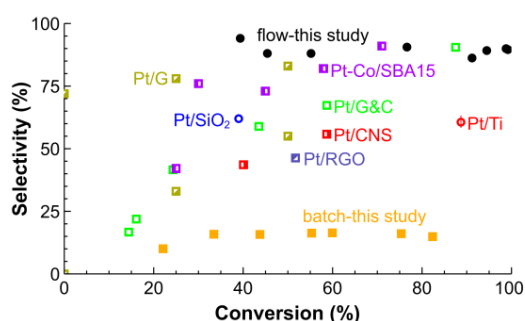


Figure 3. The selectivity to COL as a function of CAL conversion obtained in the current work compared with the literature data in other reactors.

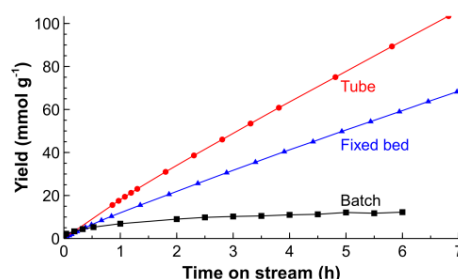


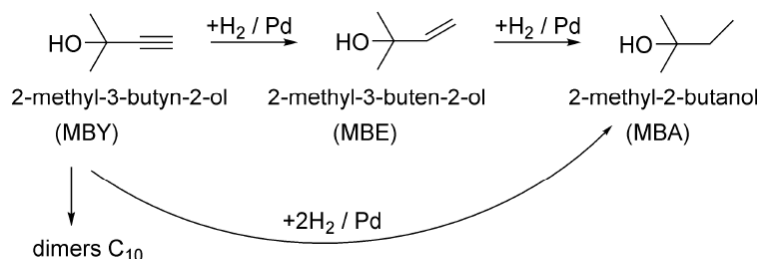
Figure 4. The comparison of cumulative COL yield over the Pt/SiO₂ catalysts in batch, fixed bed and tube reactors at the same condition.

- ❖ **High Selectivity of COL (90.0%) at high conversion (98.8%)**
- ❖ **High stability of catalyst performance (over 100 h)**
- ❖ **Easy regeneration of catalyst (calcine at 400 °C in air for 1 h)**
- ❖ **High turnover number (3000)**
- ❖ **High product throughput (0.36 kg g_{pt}⁻¹ day⁻¹)**

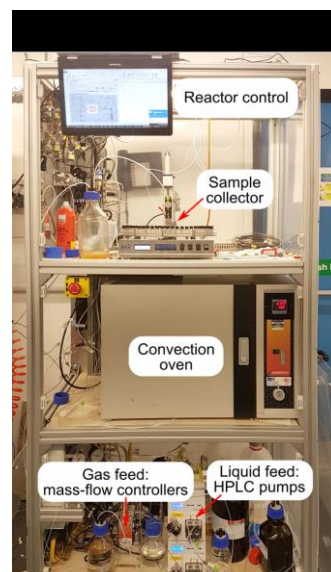
Bai et al. (2018), Catalysts, 8, 58; doi:10.3390/catal8020058

Process Intensification of Alkynol Semihydrogenation in a Tube Reactor Coated with a Pd/ZnO Catalyst

A novel continuous flow solvent-free process for selective semihydrogenation of 2-methyl-3-butyn-2-ol (MBY) to 2-methyl-3-buten-2-ol (MBE) (Scheme 1) was studied in a 5 m tube reactor wall-coated with a 5 wt % Pd/ZnO catalyst (Scheme 2).



Scheme 1. Scheme of the 2-methyl-3-butyn-2-ol (MBY) hydrogenation reaction.



Scheme 2. The hydrogenation reactor system used in the study for continuous operation.

Stoli's unique coating technology yielded fine particles with an average size of 4.2 nm in Pd/ZnO coated reactor (Figure 1). Stoli Pd/ZnO coated reactor demonstrated > 98 % selectivity in the reaction of solvent-free continuous semihydrogenation of MBY to MBE.

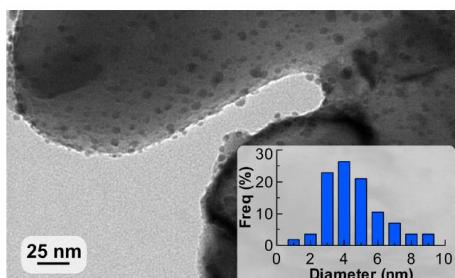


Figure 1. Transmission electron microscopy (TEM) image of the Pd nanoparticles supported on ZnO.

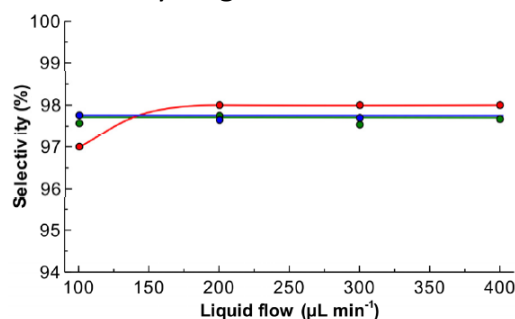


Figure 2. The effect of liquid flow and reaction temperature (red – 70, green – 50, blue – 30 °C) on MBE selectivity in solvent-free semihydrogenation of MBY.

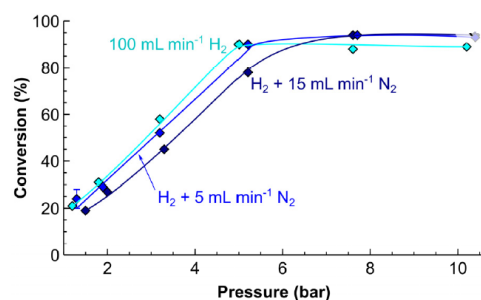


Figure 3. The effect of hydrogen pressure on MBY conversion in solvent-free semihydrogenation of MBY at 50 °C.

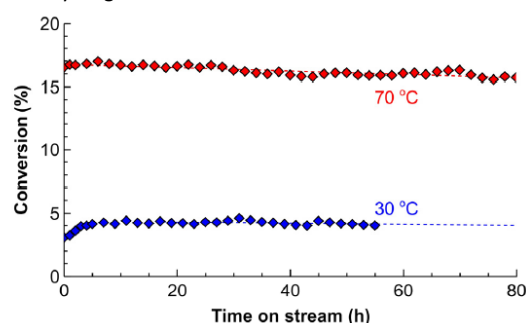


Figure 4. The stability test of the tube reactor coated with 5 wt % Pd/ZnO catalyst in the continuous solvent-free semihydrogenation of MBY.

- ❖ **High Selectivity of 97.8 % at an ambient H₂ pressure at high conversion (90%)**
- ❖ **High stability for 80 h on stream with a deactivation rate of only 0.07% per hour**
- ❖ **Continuous operation of one month with only a two-fold decrease in catalyst activity and a metal leaching below 1 parts per billion (ppb)**
- ❖ **High turnover number (90000)**

Cherkasov, Bai and Rebrov (2017), *Catalysts*, 7, 358; doi:10.3390/catal7120358