MONO- AND BIMETALLIC CATALYSTS BASED ON HYPER-CROSSLINKED POLYSTYRENE FOR HYDROGENATION OF BIOMASS-DERIVED LEVULINIC ACID

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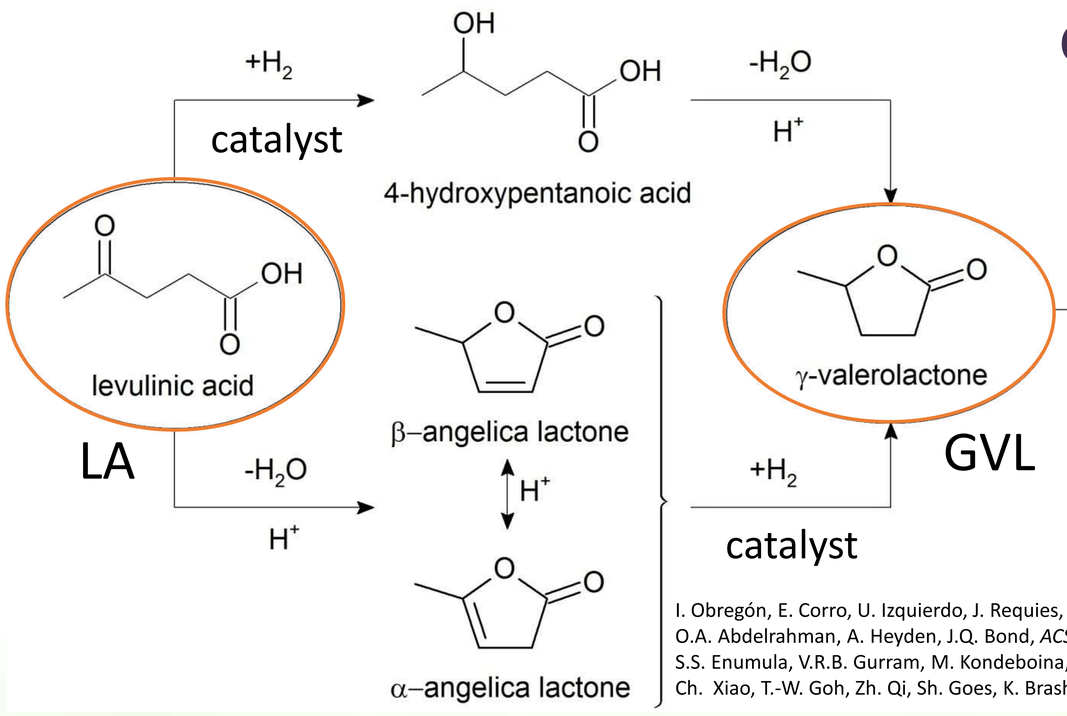
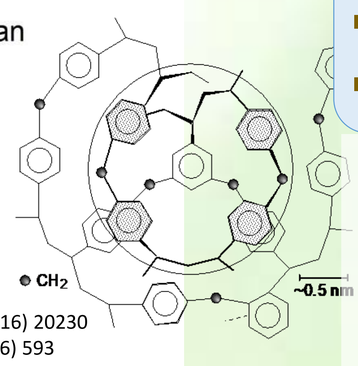
Catalytic conversion of LA to GVL



I. Obregón, E. Corro, U. Izquierdo, J. Requies, P.L. Arias, *Chin. J. Catal.*, 35 (2014) 656
O.A. Abdelrahman, A. Heyden, J.Q. Bond, *ACS Catal.*, 4 (2014) 1171
S.S. Enumula, V.R.B. Gurram, M. Kondeboina, D.R. Burri, S.R.R. Kamaraju, *RSC Adv.*, 6 (2016) 20230
Ch. Xiao, T.-W. Goh, Zh. Qi, Sh. Goes, K. Brashler, Ch. Perez, W. Huang, *ACS Catal.*, 6 (2016) 593

Hypercrosslinked polystyrene (HPS) as catalytic support



Synthesized Ru/HPS catalysts:

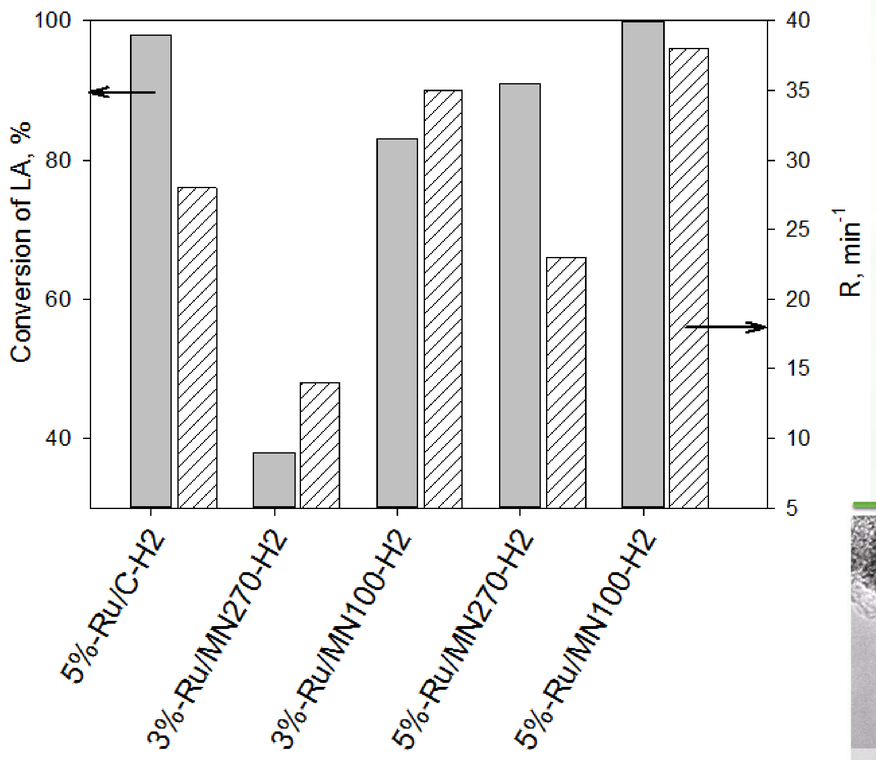
- *3%-Ru/MN100*
- *5%-Ru/MN100*
- *3%-Ru/MN270*
- *5%-Ru/MN270*

All the samples were activated in H_2 flow (300°C, duration 2 h)

The following types of HPS produced by Purolite Ltd. (UK) were used:

- MN100 (bearing tertiary amino-groups)
- MN270 (non-functionalized)

temperature 100°C, hydrogen partial pressure 2 MPa, LA-to-catalyst ratio 100 g/g, stirring rate 1500 rpm



Catalyst (activated with H_2)	X_{LA}, % (after 100 min of reaction time)	R, min^{-1}
5%-Ru/C (*Acros Organics*)	98	28
3%-Ru/MN270	38	14
3%-Ru/MN100	83	35
5%-Ru/MN270	91	23
5%-Ru/MN100	~100	38

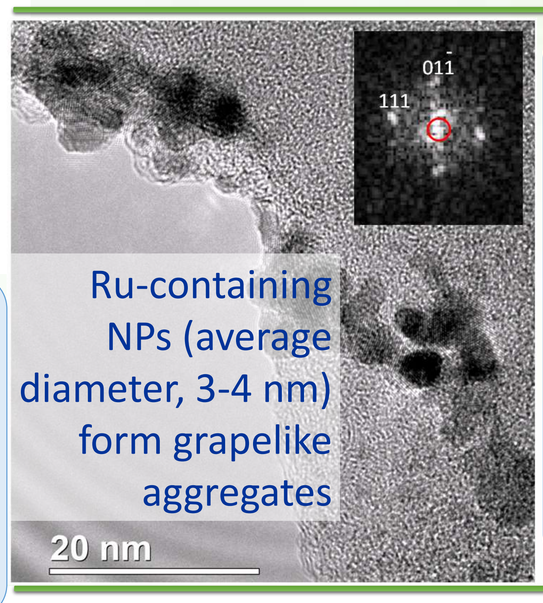
Selectivity was ~100% in all the experiments

$$R\ (mol_{LA} \cdot mol_{Ru}^{-1} \cdot min^{-1}) = (N_{LA,X2} - N_{LA,X1}) \times N_{Ru}^{-1} \times (\tau_2 - \tau_1)^{-1}$$

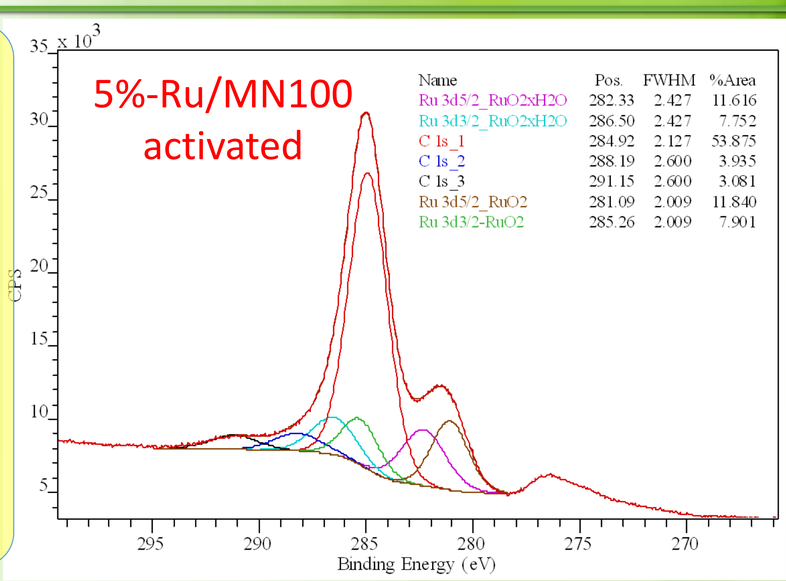
Synthesized Ru-Co/HPS catalysts:

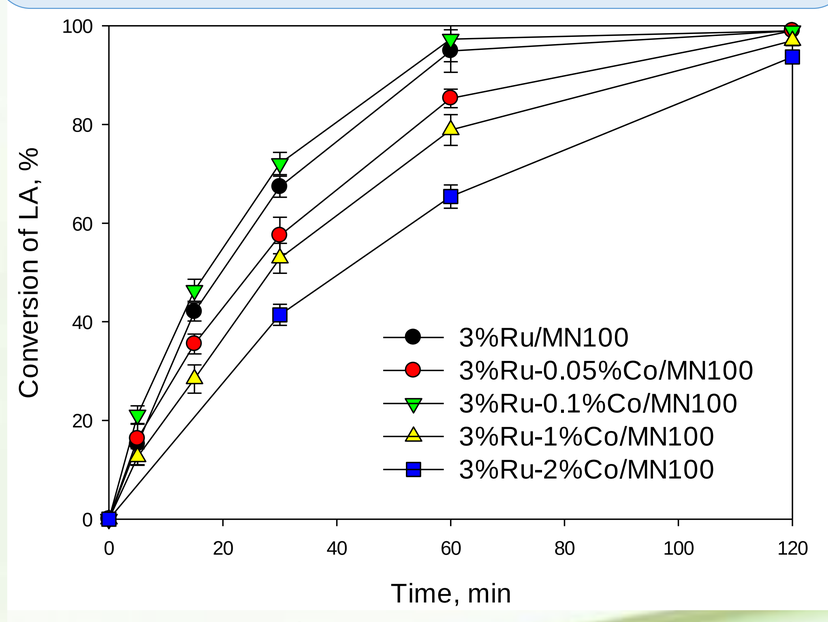
- *3%Ru-0.05%Co/MN100*
- *3%Ru-0.1%Co/MN100*
- *3%Ru-1%Co/MN100*
- *3%Ru-2%Co/MN100*

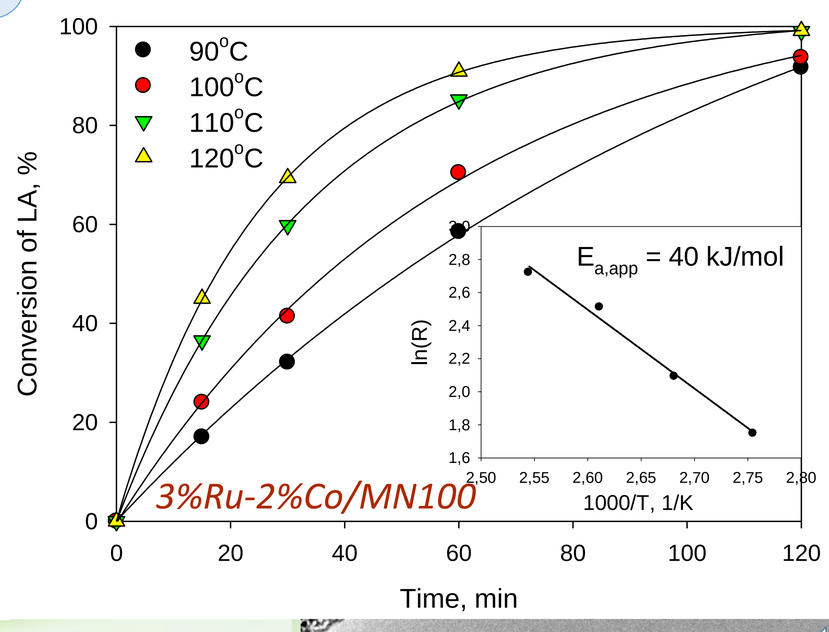
All the samples were activated in H_2 flow (300°C, duration 2 h)

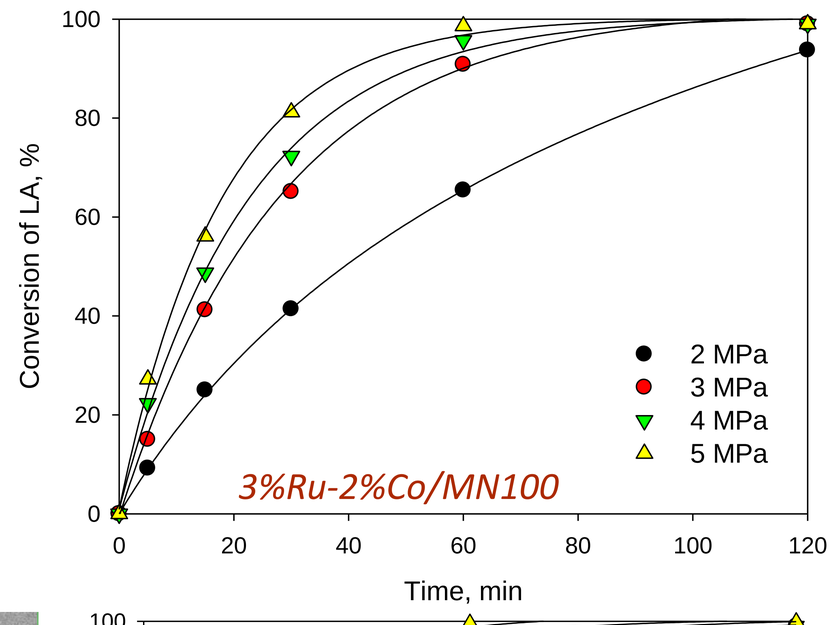


Ru(0) is absent on the surface of activated 5%-Ru/MN100, thus the activity of 5%-Ru/MN100 can be attributed to the formation of small RuO_2 nanoparticles (NPs)



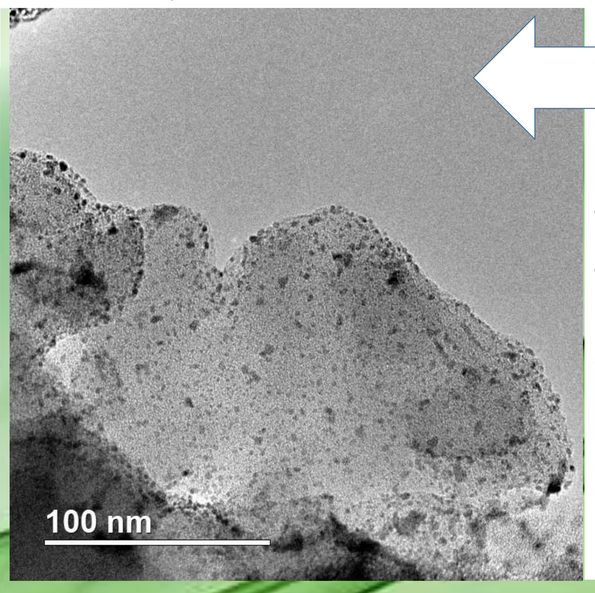


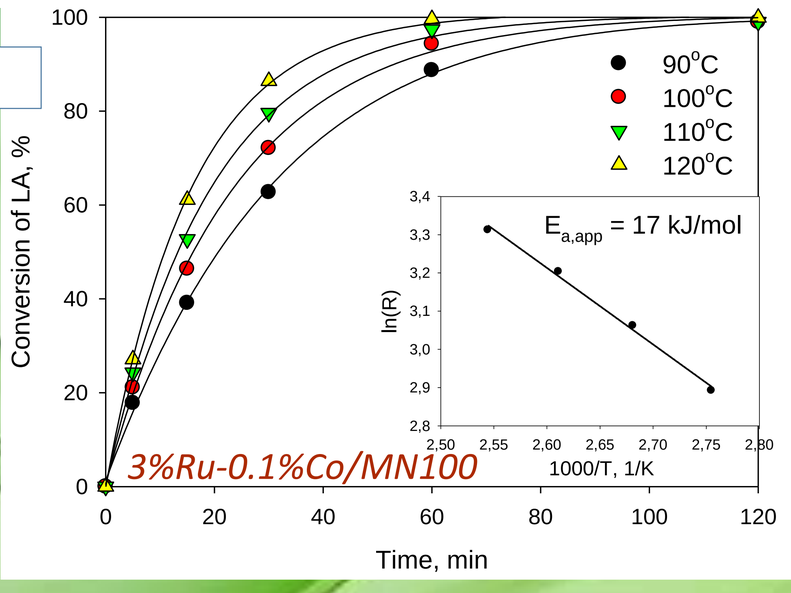




100°C, H_2 partial pressure 2 MPa, LA-to-catalyst ratio 50 g/g

Introduction of Co in the catalyst composition results in redistribution of nanoparticles of catalytically active phase (RuO_2) inside the polymeric matrix of HPS.
No products of chemical interaction of Co- and Ru-containing species were found on the catalyst surface





M.E. Grigorev et al., Catalysis Today, 2020, in press

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