Supporting Information: Biofuel synthesis from sorbitol by aqueous phase hydrodeoxygenation over bifunctional catalysts: In-depth study of the Ru-Pt/SiO_2-Al_2O_3 catalytic system

Davina Messou, Laurence Vivier, Christine Canaff and Catherine Especel *

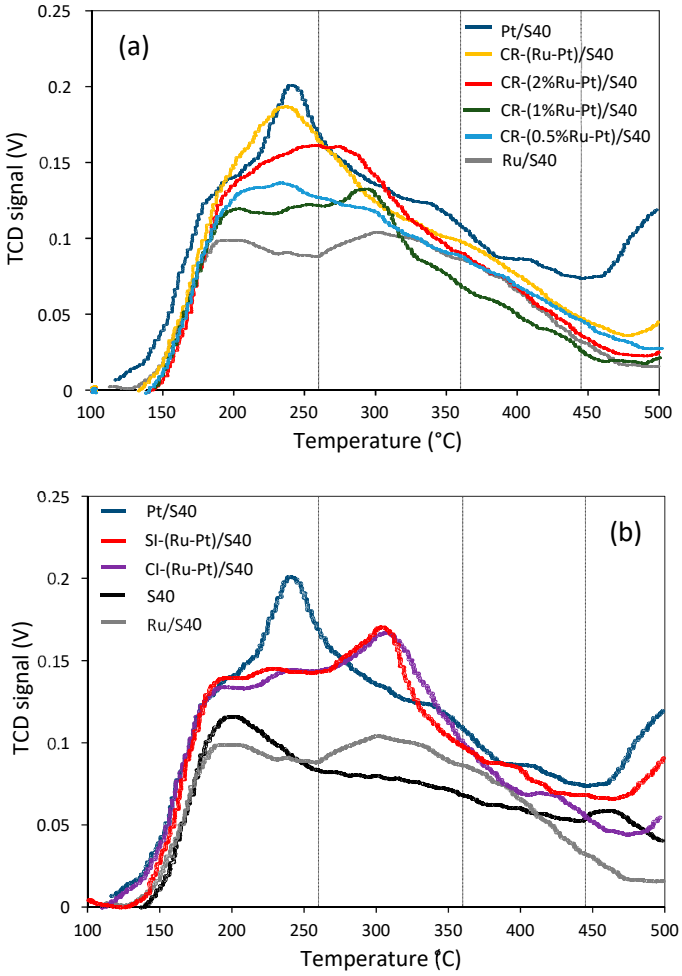

Figure S1. NH_3-TPD profiles of the monometallic Ru/S40 and Pd/S40 catalysts, and of the Ru-Pt/S40 bimetallic catalysts prepared by: (**a**) catalytic reduction deposition (CR); (**b**) co-impregnation (CI) and successive impregnations (SI).

The temperature ranges used to determine the acidity strength are materialized by vertical lines: Sites of very weak acidity between 100–260 °C, of weak acidity between 260–360 °C, of strong acidity between 360–445 °C, and of very strong acidity between 445–500 °C. Due to water desorption for temperatures higher to 450 °C, the total acidity of the catalysts was determined by integration of the TPD profiles between 100 and 450 °C.

Table S1. Carbon distribution in the liquid and gas phases at 80–96% of sorbitol conversion for the Pt- and Ru-based catalysts supported on S40 prepared by successive impregnations (SI) and co-impregnation (CI). Conditions: 10 wt.% sorbitol solution, 240 °C, 60 bar under H_2.

			Carbon distribution (mol_C %)				
Compounds	**n_C***	**n_O****	**Pt/S40 2 h**	**Ru/S40 2 h**	**SI-(Ru-Pt) 1 h**	**SI-(Pt-Ru) 2 h**	**CI-(Ru-Pt) 1 h**
Liquid phase			**74.9**	**59.8**	**49.5**	**67.3**	**65.6**
Mannitol	6	6	3.7	9.9	9.6	6.2	6.4
Sorbitan	6	5	47.9	11.7	11.9	6.5	23.4
Isosorbide	6	4	20.7	-	13.7	25.6	0.0
1,2,6-Hexanetriol	6	3	-	1.0	0.6	0.1	0.9
1,2-Hexanediol	6	2	0.1	0.6	0.4	0.4	0.8
Tetrahydropyran-2-methanol	6	2	-	0.6	0.2	0.8	0.3
2,5-Dimethylfuran	6	1	0.1	0.4	0.3	< 0.1	0.1
2,5-Dimethyltetrahydrofuran	6	1	-	-	-	0.7	-
2-Methylcyclopentanol	6	1	-	-	-	-	1.1
4-Methyl-2-pentanol	6	1	-	-	0.2	-	3.4
Hexanols	6	1	0.2	0.4	0.8	1.4	1.1
Xylitol	5	5	-	4.2	-	-	21.6
1,2-Pentanediol	5	2	0.4	2.4	1.8	2.1	1.4
2-Methyltetrahydrofuran	5	1	0.3	1.9	2.1	1.9	0.6
Tetrahydropyran	5	1	0.2	-	0.3	0.2	0.1
2-Methylfuran	5	1	-	0.2	-	< 0.1	0.2
Pentanols	5	1	< 0.1	-	-	< 0.1	0.0
Erythritol	4	4		8.4	0.0	6.1	0.0
Propanols	3	1	1.2	7.9	4.5	5.2	4.2
Ethanol	2	1	-	-	-	-	0.0
Methanol	1	1	0.0	10.2	3.2	10.1	0.0
Gaseous phase			**5.5**	**23.9**	**32.3**	**28.2**	**20.6**
CO_2	1	2	0.7	0.1	0.5	0.4	0.7
Hydrocarbons			4.8	23.8	31.8	27.8	19.9
Hexane	6	-	3.7	9.6	24.4	2.3	2.3
Pentane	5	-	0.4	1.6	0.7	1.5	1.4
Butane	4	-	0.2	1.0	0.4	1.4	0.8
Propane	3	-	0.1	0.8	0.2	1.0	0.5
Ethane	2	-	0.1	1.1	0.3	1.8	0.8
Methane	1	-	0.2	9.7	5.8	19.8	14.1

* Number of carbon atoms contained in the compound.

** Number of oxygen atoms contained in the compound.

0.0: Traces of compound appear at the end of the reaction.

-: The compound is not detected after 6 hours.

Table S2. Carbon distribution in the liquid and gas phases at 80–96 % of sorbitol conversion for the Pt- and Ru-based catalysts supported on S40 prepared by catalytic reduction deposition (CR). Conditions: 10 wt.% sorbitol solution, 240 °C, 60 bar under H_2.

			Carbon distribution (mol_C %)					
Compounds	**n_C***	**n_O****	**Pt/S40**	**Ru/S40**	**CR-(Ru-Pt)**	**CR-(2%Ru-Pt)**	**CR-(1%Ru-Pt)**	**CR-(0.5%Ru-Pt)**
			2 h	**2 h**	**2 h**	**2 h**	**2 h**	**3 h**
Liquid phase			**74.9**	**59.8**	**49.9**	**73.6**	**59.1**	**65.6**
Mannitol	6	6	3.7	9.9	6.5	5.3	-	-
Sorbitan	6	5	47.9	11.7	6.8	9.1	34.1	18.3
Isosorbide	6	4	20.7	-	0.0	13.3	4.0	17.2
1,2,6-Hexanetriol	6	3	-	1.0	1.5	0.3	2.2	-
1,2-Hexanediol	6	2	0.1	0.6	0.5	0.1	0.5	0.3
Tetrahydropyran-2-methanol	6	2	-	0.6	0.8	1.4	1.0	0.8
2,5-Dimethylfuran	6	1	0.1	0.4	< 0.1	-	-	< 0.1
2,5-Dimethyltetrahydrofuran	6	1	-	-	1.1	1.3	-	-
2-Methylcyclopentanol	6	1	-	-	-	-	-	0.2
4-Methyl-2-pentanol	6	1	-	-	-	0.1	< 0.1	0.1
Hexanols	6	1	0.2	0.4	1.5	0.2	0.6	0.7
Xylitol	5	5	-	4.2	-	-	-	-
1,2-Pentanediol	5	2	0.4	2.4	4.4	1.5	2.9	6.1
2-Methyltetrahydrofuran	5	1	0.3	1.9	2.8	2.8	1.4	-
Tetrahydropyran	5	1	0.2	-	0.3	0.3	0.1	0.6
2-Methylfuran	5	1	-	0.2	< 0.1	< 0.1	-	0.1
Pentanols	5	1	< 0.1	-	0.0	0.3	0.0	0.1
Erythritol	4	4	-	8.4	6.9	10.6	0.0	0.0
Propanols	3	1	1.2	7.9	12.8	27	11.1	20.6
Ethanol	2	1	-	-	-	-	-	-
Methanol	1	1	0.0	10.2	4.0	0.0	1.2	0.5
Gaseous phase			**5.5**	**23.9**	**31.6**	**15.4**	**21.8**	**14.4**
CO_2	1	2	0.7	0.1	0.8	0.6	0.3	2.0
Hydrocarbons			4.8	23.8	30.8	14.8	21.5	12.4
Hexane	6	-	3.7	9.6	1.8	1.9	11.4	8.2
Pentane	5	-	0.4	1.6	1.2	1.3	1.4	1.0
Butane	4	-	0.2	1.0	1.5	1.1	0.7	0.4
Propane	3	-	0.1	0.8	1.6	0.7	0.5	0.2
Ethane	2	-	0.1	1.1	2.4	0.7	0.6	0.1
Methane	1	-	0.2	9.7	22.2	9.1	7.0	2.5

* Number of carbon atoms contained in the compound.

** Number of oxygen atoms contained in the compound.

0.0: Traces of compound appear at the end of the reaction.

-: The compound is not detected after 6 hours.