

CAT-18:Co and Co/Ru based catalysts synthesized by FSP for the industrial Gas-to-Liquid Fischer-Tropsch process

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The GTL - FT process converts syngas, a mixture of H₂/CO with a molar ratio equal to 2, into hydrocarbons [1]. A 10%_{wt}Co and a 10%_{wt}Co - 0.1%_{wt}Ru based catalysts supported on silica were prepared by Flame Spray Pyrolysis (FSP), characterized by BET, SEM, TEM, TPR, XRD and tested at different temperature in a FT bench scale plant using a Packed Bed Reactor (PBR). FSP allows to obtain metal oxides with high surface area and high thermal stability thanks to the dispersion, vaporization and pyrolysis of the precursors solution [2]. The solution is composed of Co(CH₃COO)₂·4H₂O (Fluka), Si(OC₂H₅)₄ (Fluka) dissolved in a 1/1 (vol/vol) mixture of CH₃CH₂COOH (Fluka)/p-xylene (Sigma Aldrich). The synthesis of the bimetallic catalyst is accomplished by FSP followed by the addition of Ru by impregnation using Ru₃(CO)₁₂ (Sigma Aldrich) as a precursor. The TPR profiles (Figure 1) of both samples show two different peaks at T= 320-360°C (Co₃O₄→CoO) and T= 700-800°C (CoO→Co) [1]. Figure 1 also highlights that the insertion of Ru decreases both peaks temperatures by ca. 20°C. The samples were tested at T= 225-260°C, P= 2.0 MPa, H₂/CO= 2 (mol/mol) with sl/h/g_{cat}= 3.0. The results summarized in Table 1 show

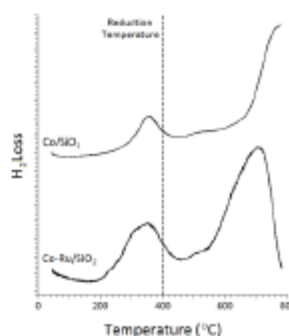


Figure 1: TPR profiles

	T (°C)	CO Conv. (%)	C ₂₊	Selectivity (%)			
				CO	CH ₄	<C ₇	>C ₇
Co	245	23.4	20.4	1	12	10	77
	255	60.7	54.0	1	10	10	79
	260	98.8	82.0	6	11	10	73
Co-Ru	225	55.8	50.2	1	9	18	72
	230	73.2	65.1	2	9	17	72
	245	94.5	77.5	6	12	14	68

that Co-Ru is more active in terms of CO conversion and C₂₊ yield if compared with the monometallic one. The non-promoted catalyst shows higher selectivity to >C₇ with respect to the Ru-doped catalyst. Finally, the selectivity toward the reaction products is not largely influenced in the range of

temperature tested.

Table 1: Catalytic results of Co and Co-Ru catalysts

Keywords: Fischer-Tropsch, Flame Spray Pyrolysis, Co-based catalysts

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