

Electronic Supplementary Information

Large-Scale Synthesis of Uniformly Loaded Cobalt Nanoparticles on Alumina for Efficient Clean Fuel Production

Ji Chan Park,* Jae In Kwon, Shin Wook Kang, Dong Hyun Chun, Ho-Tae Lee, Heon Jung, Jung-II Yang*

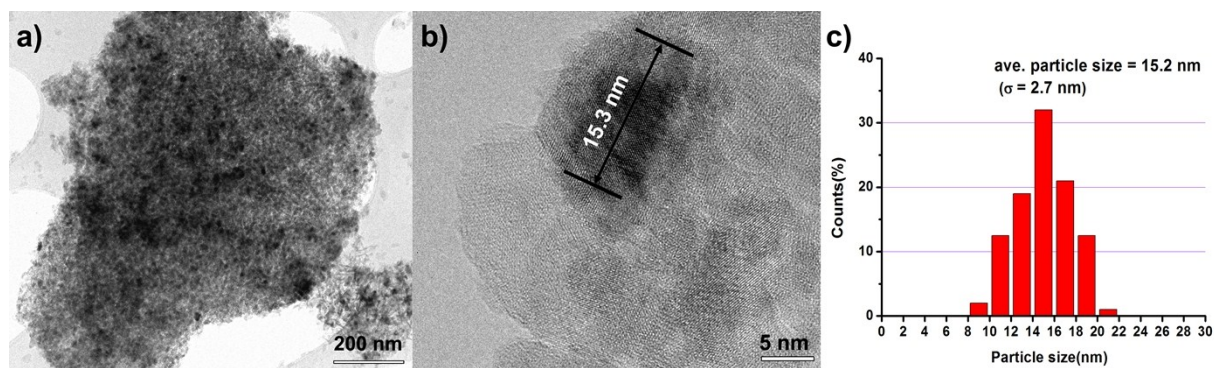


Figure S1. (a) Low-resolution and (b) high-resolution TEM images of Co/Al₂O₃ nanocatalyst and (c) Co particle size distribution histogram. The average particle size was determined by counting more than 200 dots.

Table S1. Comparison of the CO conversion data and CTY values of Co catalysts.

Catalyst	Total CO conv. (%)	CTY ($\text{mol}_{\text{CO}} \cdot \text{g}_{\text{Co}}^{-1} \cdot \text{s}^{-1}$)	Ref.
Co/SBA-15 (Co: 15 wt%)	22.3	2.5×10^{-5}	1 ^{a)}
Co/MCF (Co: 15 wt%)	49.4	5.4×10^{-5}	
CoPt/SiO ₂ (Co: 15wt%, Pt: 0.5wt%)	65.6	3.6×10^{-5}	2 ^{b)}
Co ₂ C	80.4	9.9×10^{-5}	3 ^{c)}
CoPt/Al ₂ O ₃ (Co:23wt%, Pt:0.05wt%)	75.3	9.2×10^{-5}	
Co/CNF (Co: 13wt%)	66	4.4×10^{-5}	4 ^{d)}
Co/hollow Al ₂ O ₃ sphere (Co: 10wt%)	84	Not available	5 ^{e)}
Co/Al ₂ O ₃ by impregnation method (Co: 20wt%)	43.9	4.9×10^{-5}	6 ^{f)}
Co/Al ₂ O ₃ by precipitation method (Co: 20wt%)	35.1	3.4×10^{-5}	

Catalytic tests were carried out at a) T = 210°C, P = 10 bar, H₂/CO ratio=2, GHSV=4.0 NL·g_{cat}⁻¹·h⁻¹, b) T = 210°C, P = 10 bar, H₂/CO ratio=2, GHSV=2.0 NL·g_{cat}⁻¹·h⁻¹, c) T = 220°C, P = 20 bar, H₂/CO ratio=2, GHSV=8.0 NL·g_{cat}⁻¹·h⁻¹, d) T = 210°C, P = 35 bar, H₂/CO ratio=2, e) T = 260°C, P = 10 bar, GHSV=4.5 NL·g_{cat}⁻¹·h⁻¹, H₂/CO ratio=2, f) T = 230°C, P = 10 bar, H₂/CO ratio=2, GHSV=2.4 NL·g_{cat}⁻¹·h⁻¹.

References)

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Table S2. Hydrocarbon product distribution data (wt%) of Co/Al₂O₃ nanocatalyst.

Temp. (°C)	Press. (bar)	Hydrocarbon distribution (wt%)					
		CH ₄	C ₂ -C ₄ paraffins	C ₂ -C ₄ olefins	C ₅ -C ₁₂	C ₁₃ -C ₁₈	C ₁₉₊
230	10	22.8	6.8	4.6	26.7	19.1	20.0
	20	17.9	5.3	5.2	25.8	18.7	27.1
240	10	30.8	11.3	3.0	27.8	14.0	13.1
	20	20.4	8.1	2.9	31.3	17.8	19.5
250	10	31.0	13.2	3.5	33.1	11.7	7.5
	20	22.8	9.0	1.9	36.7	15.6	14.0
260	10	30.1	12.8	3.5	36.5	10.9	6.2
	20	29.7	10.4	2.3	36.3	13.3	8.0

Table S3. Carbon chain growth probability (α) at 20 bar.

Temperature (°C)	230	240	250	260
α value	0.885	0.864	0.848	0.785