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Optimized reforming of biomass derived gas based on thermodynamic and kinetics analysis with activated carbon fibers supported Ni-Al₂O₃

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Supplementary material

TableS1 Volume fraction of various components of different biomass derived gas (N₂ free)

Biomass	Catalysts	H ₂	CO	CH ₄	CO ₂	C ₂ -C ₄	Reference
Wood Sawdust	9Ni1FeAl	36.5	41.6	6.2	14.5	1.2	[S1]
	Sand	17.4	45.5	14.8	14.5	7.8	[S1]
Corn Stover	-	16.20	20.88	12.19	48.85	5.72	[S2]
Wood Chips	-	29.59	32.87	4.93	32.58	-	[S3]
Sawdust	Fe/CaO	21.5	33.5	13.0	26.5	5.5	[S4]

Reference:

[S1] Dong L., Wu C., Ling H., Shi J., Williams, P. T., Huang, J. (2016). Development of Fe-promoted Ni-Al catalysts for hydrogen production from gasification of wood sawdust. *Energy & Fuels*, 31(3), 2118-2127.

[S2] Zhang Y., Ke C., Gao Y., Liu S., Pan Y., Zhou N., Wang Y., Fan L., Peng P., Li B., Ruan R. (2019). Syngas production from microwave-assisted air gasification of biomass: Part 2 model validation. *Renewable energy*, 140, 625-632.

[S3] Yao Z., You S., Ge T., Wang, C. H. (2018). Biomass gasification for syngas and biochar co-production: Energy application and economic evaluation. *Applied Energy*, 209, 43-55.

[S4] Yang S., Zhang X., Chen L., Sun L., Xie X., Zhao, B. (2017). Production of syngas from pyrolysis of biomass using Fe/CaO catalysts: effect of operating conditions on the process. *Journal of Analytical and Applied Pyrolysis*, 125, 1-8.

TableS2 Detailed distribution of components for raw gas (Catalyst dosage: 0.5g; Reaction temperature:

800 °C; WHSV: 24000 mL·h⁻¹·gcat⁻¹)

Components	Flow rate(mL/min)				
	CH ₄	CO ₂	CO	H ₂	N ₂
Effect of CH ₄	20	50	0	0	130
	40	50	0	0	110
	60	50	0	0	90
	80	50	0	0	70
Effect of CO ₂	50	20	0	0	130
	50	40	0	0	110
	50	60	0	0	90
	50	80	0	0	70
Effect of CO	50	50	20	0	80
	50	50	40	0	60
	50	50	60	0	40
	50	50	80	0	20
Effect of H ₂	50	50	0	20	80
	50	50	0	40	60
	50	50	0	60	40
	50	50	0	80	20

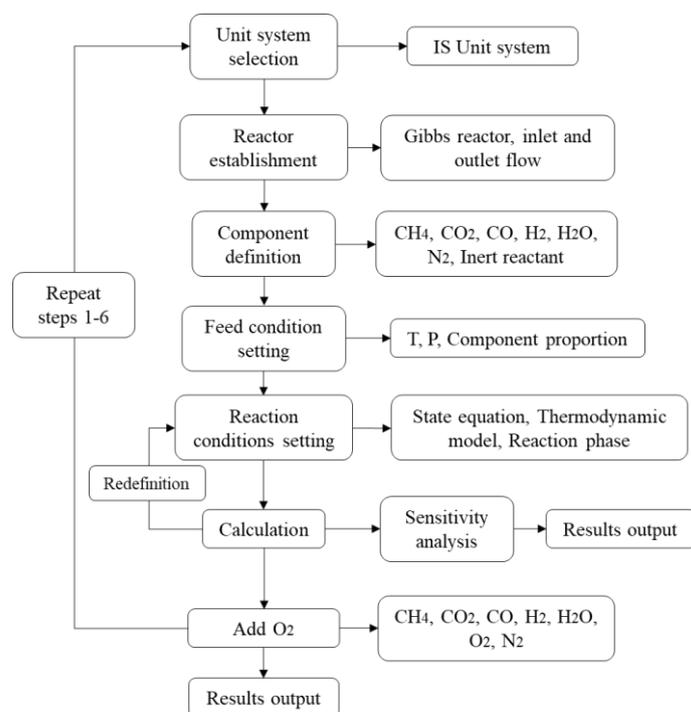
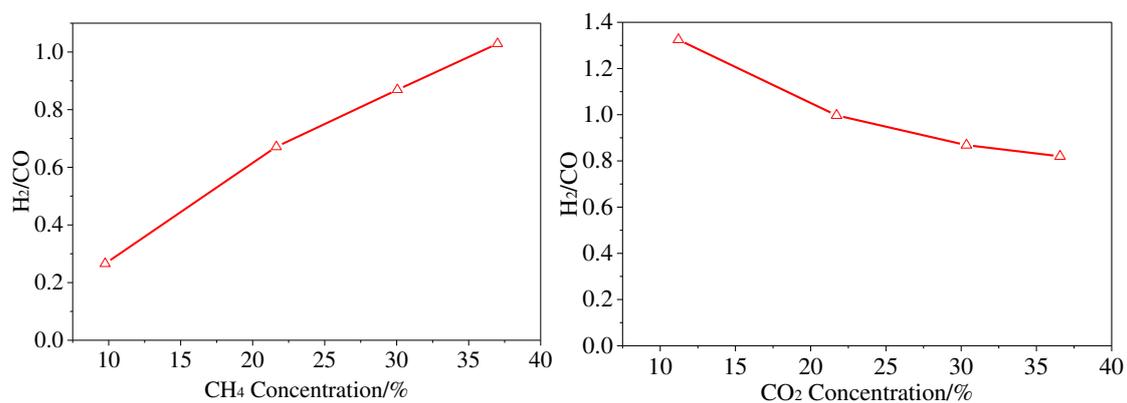


Figure S1 Flow chart of thermodynamic analysis



FigureS2 Effect of CH₄ and CO₂ on the ratio of H₂/CO (Catalyst dosage: 0.5 g; Reaction temperature: 800 °C;

WHSV: 24000 mL·h⁻¹·gcat⁻¹)

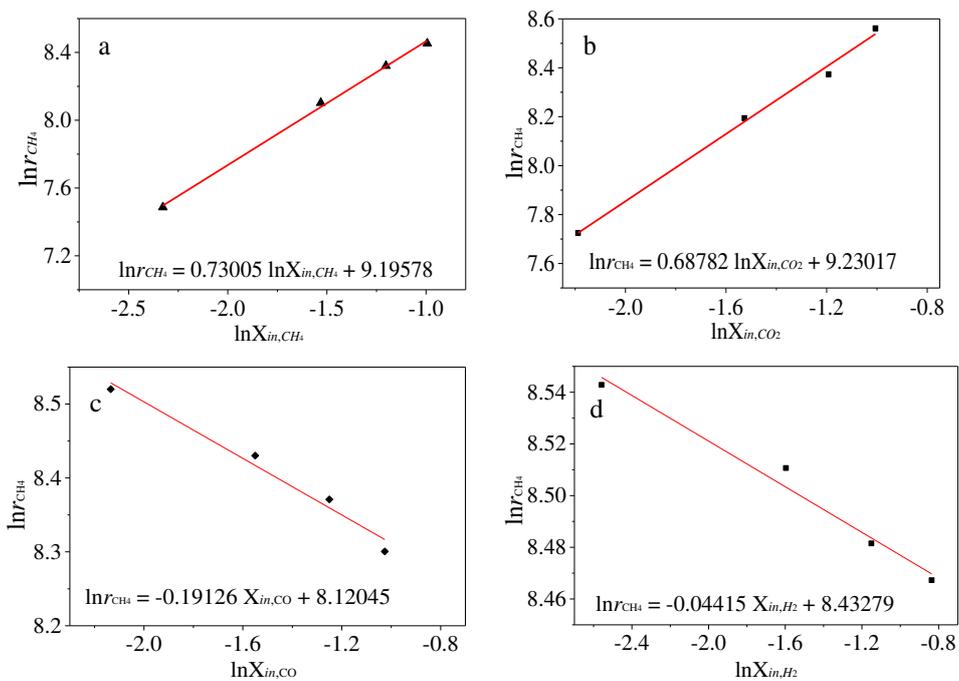


Figure S3 Calculation of different reaction orders (a: CH₄; b: CO₂; c: CO; d: H₂)

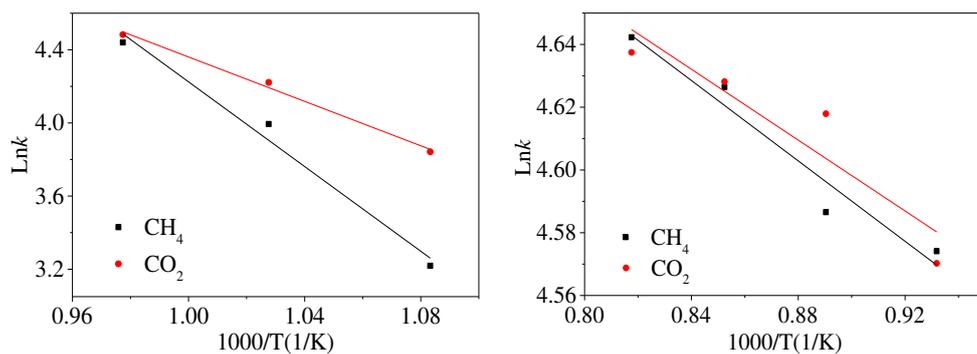


Figure S4 Calculation of different apparent activation energy (a: 650 °C ~750 °C; b: 800 °C ~950 °C)

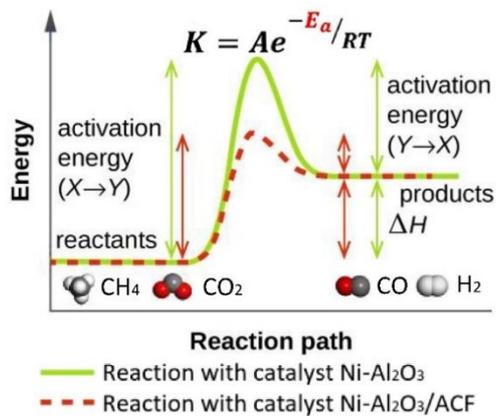


Figure S5 Schematic of reaction activation