

Supplementary Information for

Non-Thermal Plasma Catalysis for Conversion of CO₂ and CH₄ to Oxygenates: A Mini Review

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Table S1. Comparison of the traditional thermal catalysis with NTP for dry reforming of CO₂.¹⁻

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Feature Dimension	Thermal catalysis	NTP
1. Conversion Efficiency (Single-Pass)		
CO ₂	60% - 90%	10% - 90%
CH ₄	70% - 95%	15% - 90%
2. Energy Efficiency		
Typical Value	60% - 85% (Based on LHV, with heat recovery)	10% - 30% (Pure DBD); 20% - 50% (PEC)
Specific Energy (for syngas)	4 - 8 kWh/Nm ³ (Reaction heat only)	15 - 50 kWh/Nm ³ (Electrical input)
3. Reaction Conditions		
Reaction Temperature	600 - 900 °C	~50 - 100 °C (Bulk gas temperature)
Operating Pressure	1-30 bar (Often pressurized)	Atmospheric (mostly) - 5 bar
4. Throughput & Scale		
Typical Space Velocity (GHSV)	5,000 - 20,000 h ⁻¹ (Industrial)	500 - 5,000 h ⁻¹ (Equivalent)
Scale-up Path	Reactor size scaling	Modular Parallelization
5. Dynamic Response		
Start-up Time	Several hours (to reach steady state)	Milliseconds to seconds (Instant on/off)
Load Flexibility Range	Narrow (50%-110%)	Very wide (10%-100%)
6. Economic Indicators		
CAPEX (Estimate)	\$20 - 50 million (for 100 tons CO ₂ /day)	High uncertainty, but modularity may reduce large-unit cost
Estimated Syngas Cost	\$0.15 - 0.40 /Nm ³	Currently far above market price, heavily reliant on very low electricity price & carbon price

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