Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supporting Information for

Ethane Oxidative Dehydrogenation with CO2 on thiogallates

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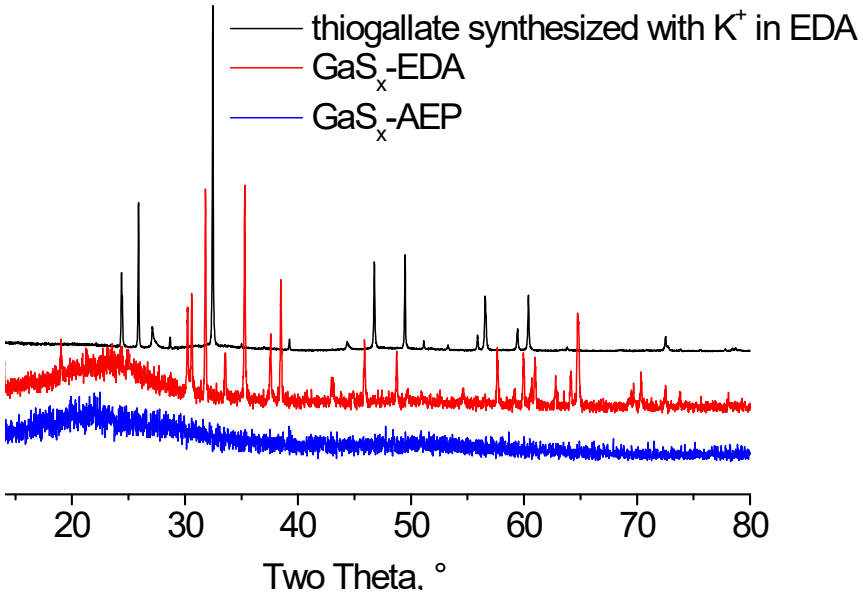


Fig. S1. PXRD patterns of the obtained phases in presence or absence of alkali cations with organic templates (EDA, AEP).

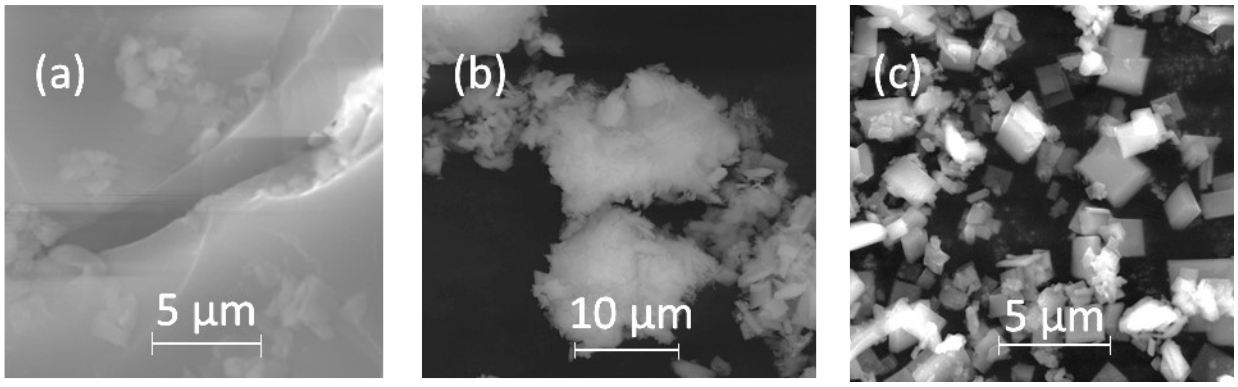


Fig. S2. SEM micrographs of the solids obtained at 190 °C for 7d from (a)) Ga-S-AEP, (b)) Ga-S-EDA systems, (c) Ga-S-EDA with K^+.

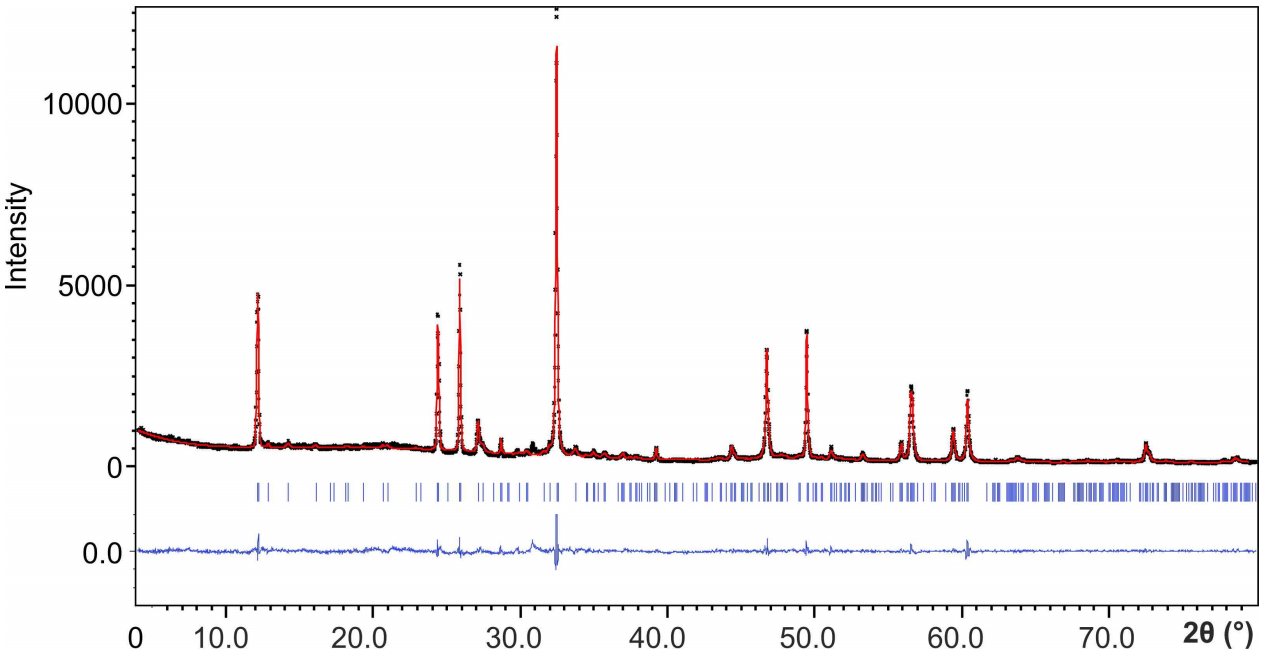
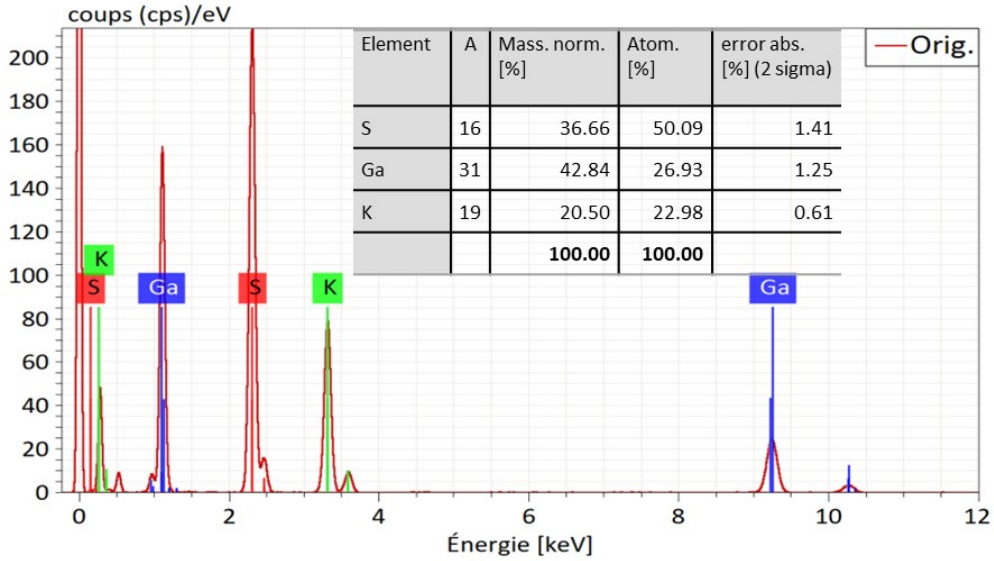


Fig. S3. PXRD patterns of as-prepared $KGaS_2$ with EDA attesting of the sample purity. Cross symbol is the observed signal, red line is the calculated signal, blue segments show the position of the expected reflections, blue line the differences between observed and calculated intensities.



Element	A	Mass. norm. [%]	Atom. [%]	error abs. [%] (2 sigma)
S	16	36.66	50.09	1.41
Ga	31	42.84	26.93	1.25
K	19	20.50	22.98	0.61
		100.00	**100.00**	

Fig. S4. EDS $KGaS_2$ and elemental quantitative data of the $KGaS_2$.

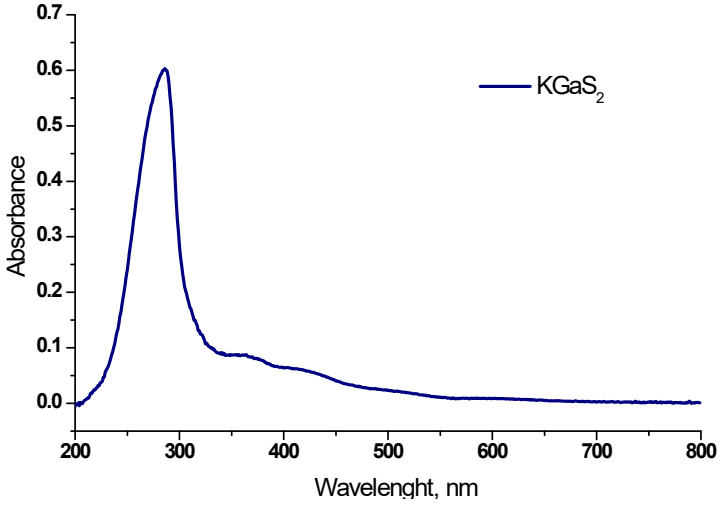


Fig. S5. UV-Vis absorption spectra of the EDA synthesized.

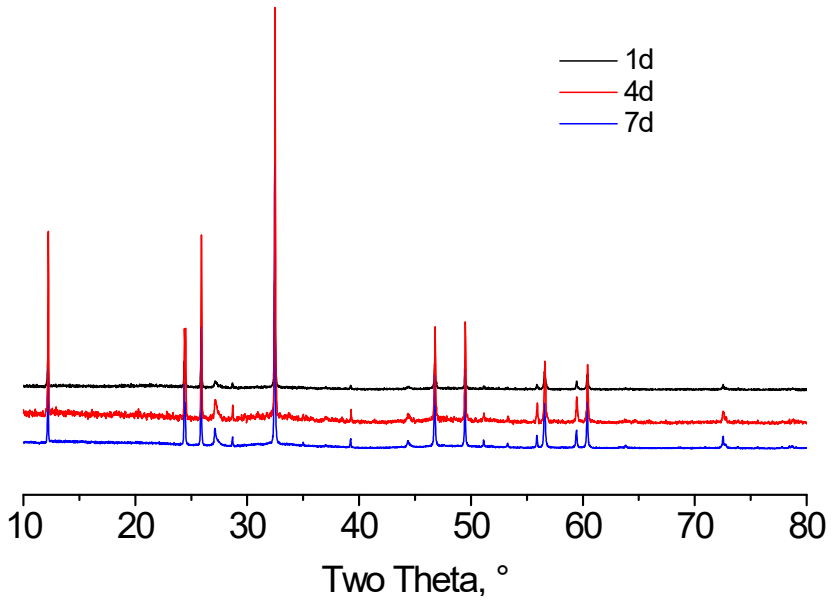


Fig. S6. PXRD patterns of as-prepared $KGaS_2$ with various crystallization time (1-7 days).

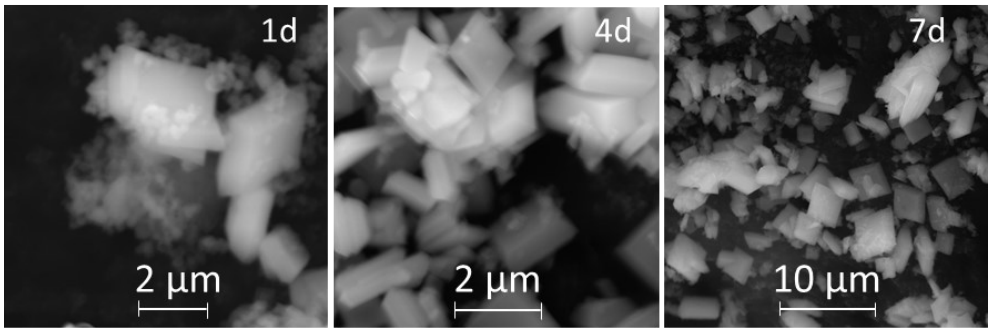


Fig. S7. SEM micrographs of $KGaS_2$ with ethylenediamine at 190 °C were prepared in the period of 1-7d.

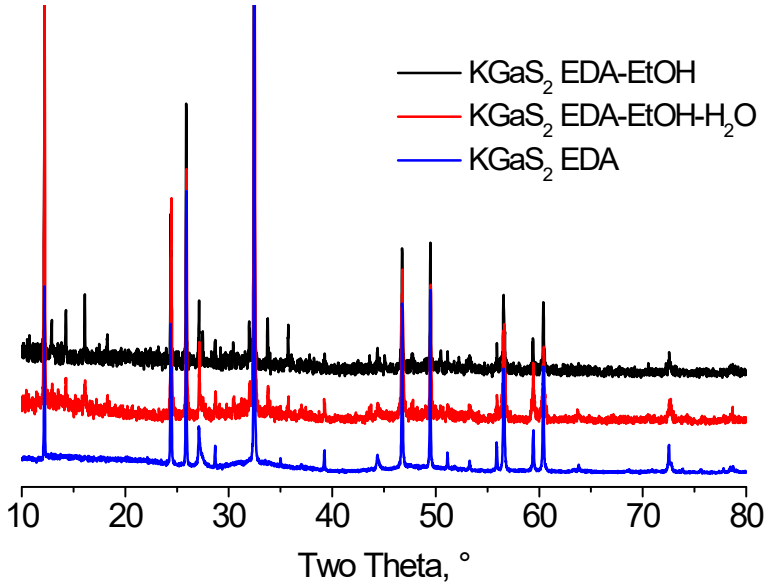


Fig. S8. PXRD patterns of $KGaS_2$ prepared with different solvents at 190°C for 7 days.

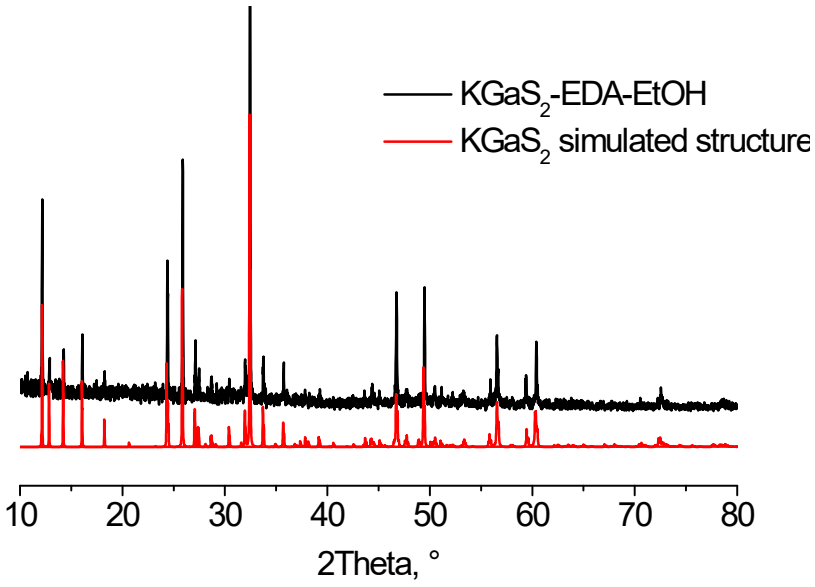


Fig. S9. PXRD patterns of as-prepared $KGaS_2$ with EDA-EtOH and simulated structure.

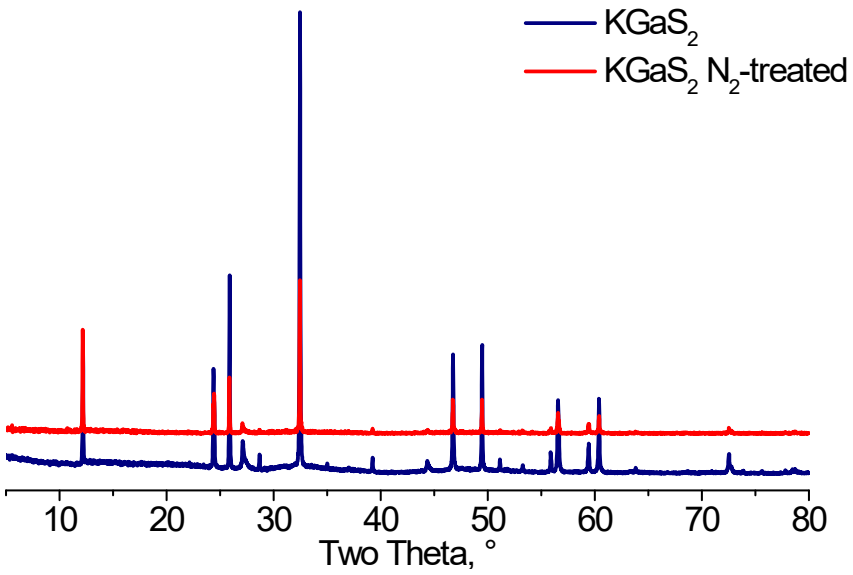


Fig. S10. PXRD patterns of $KGaS_2$ as-prepared and N_2-treated sample at 800 °C.

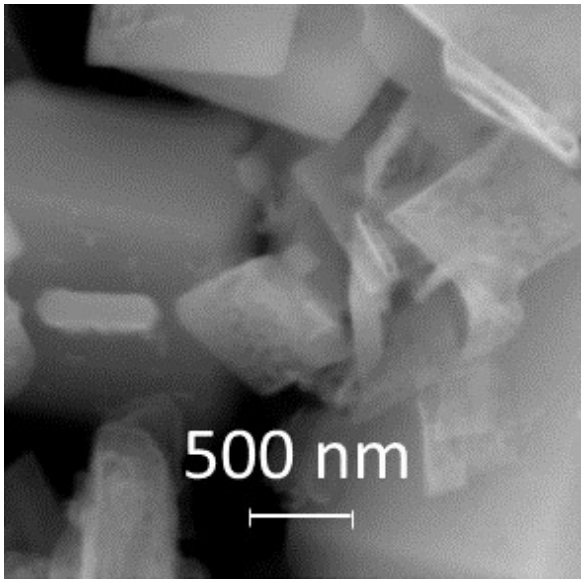


Fig. S11. SEM images of $KGaS_2$ N_2-treated at 800 °C.

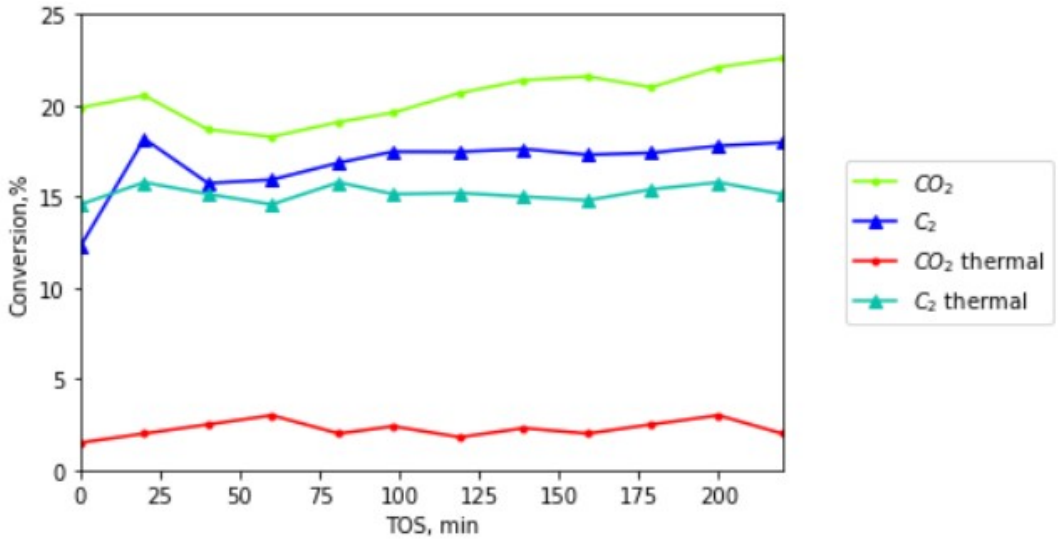


Fig. S12. C_2H_6 and CO_2 conversion on $KGaS_2$ based catalysts (P = 1 atm, C_2H_6/CO_2 = 1/0.74, WHSV =5.9 h^{-1}, 700 °C).

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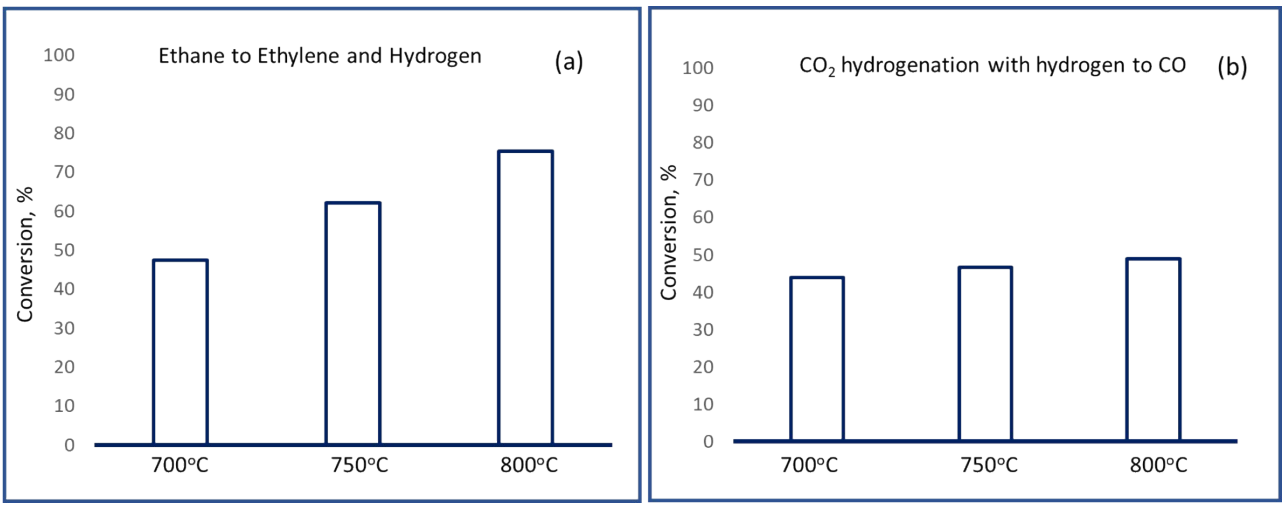

Fig. S13. Thermodynamic equilibrium conversions at different temperature, assuming isothermal temperature profile for a) ethane conversion to ethylene and hydrogen at atmospheric pressure b) CO_2 hydrogenation with hydrogen (CO_2/H_2 -1) to CO at atmospheric pressure (calculated with AspenHysys v12)

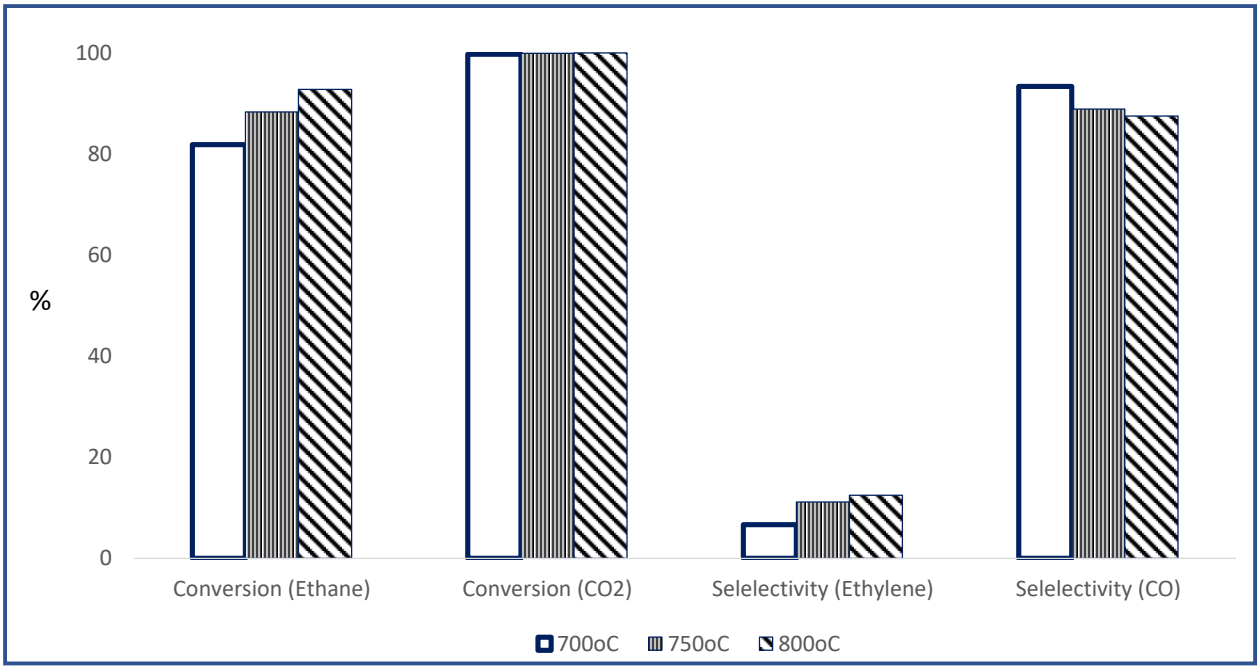

Fig. S14. Equilibrium product distribution at different temperature, assuming isothermal temperature profile in the system (CO, CO_2, ethane, ethylene, hydrogen) containing initially the equal molar composition of CO_2 and ethane at atmospheric pressure (calculated with AspenHysys v12)