XV JORNADA DE JÓVENES INVESTIGADORES/AS DEL I3A

Intensified Catalytic CO_2 Conversion into e-Fuels: A Study of Different Process Intensification Strategies.

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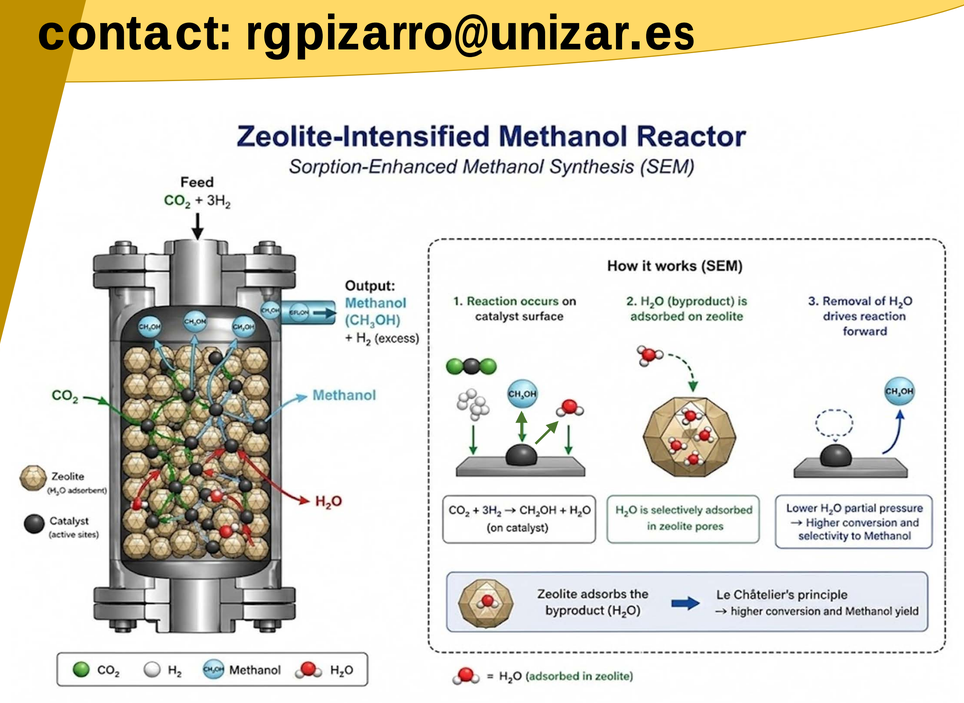

Materials and Methods

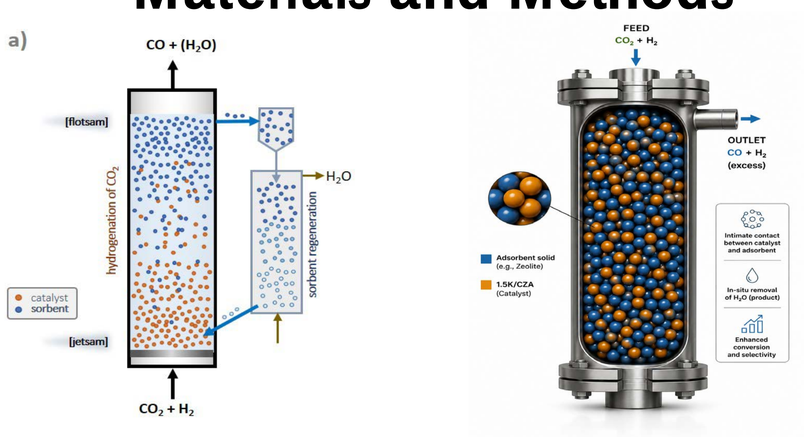

Figure 1. Scheme of the (a) Sorption–Enhanced Fluidized Bed Reactor + Continuous Sorbent Feeding (SEFBR+CSF); (b) Sorption–Enhanced Fixed Bed Reactor

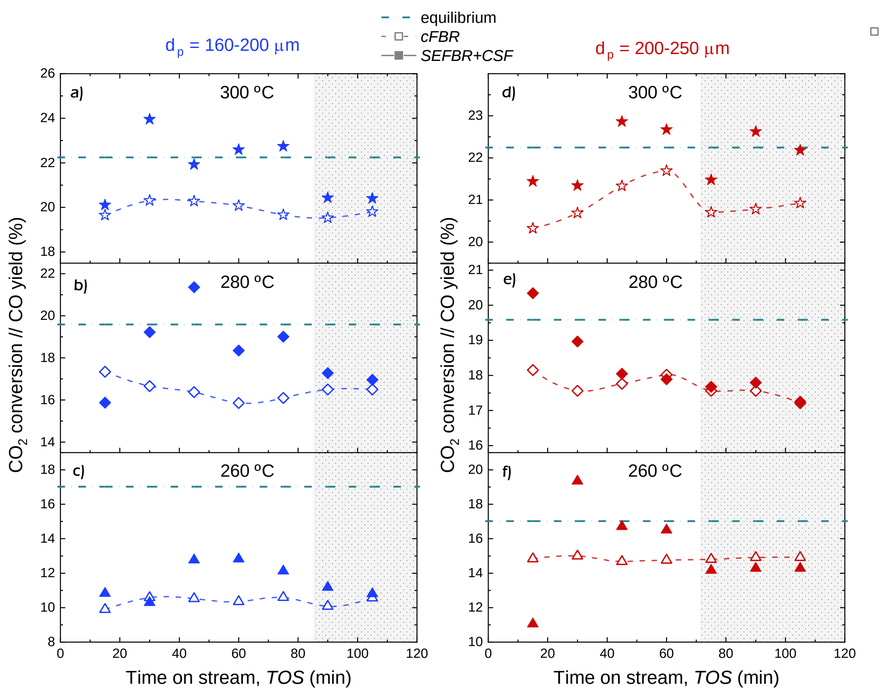

Figure 2. CO yield for both d_p ranges (160-200 μm and 200-250 μm) as a function of time-on-stream (TOS) in the cFBR (hollow symbols) and SEFBR+CSF (solid symbols) configurations. (Extracted from [1])

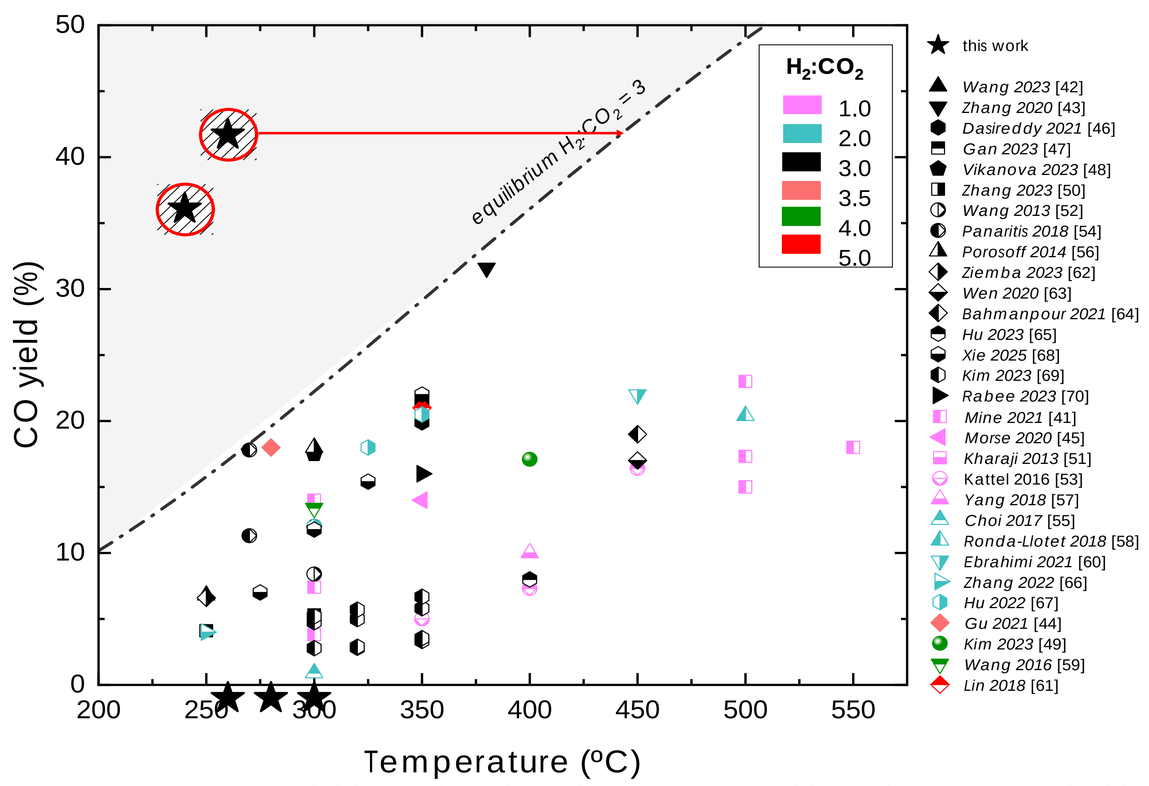

Figure 3. CO yield as a function of Temperature. This work represented with stars. Data compiled from literature with different symbols and colours. (Extracted from [1])

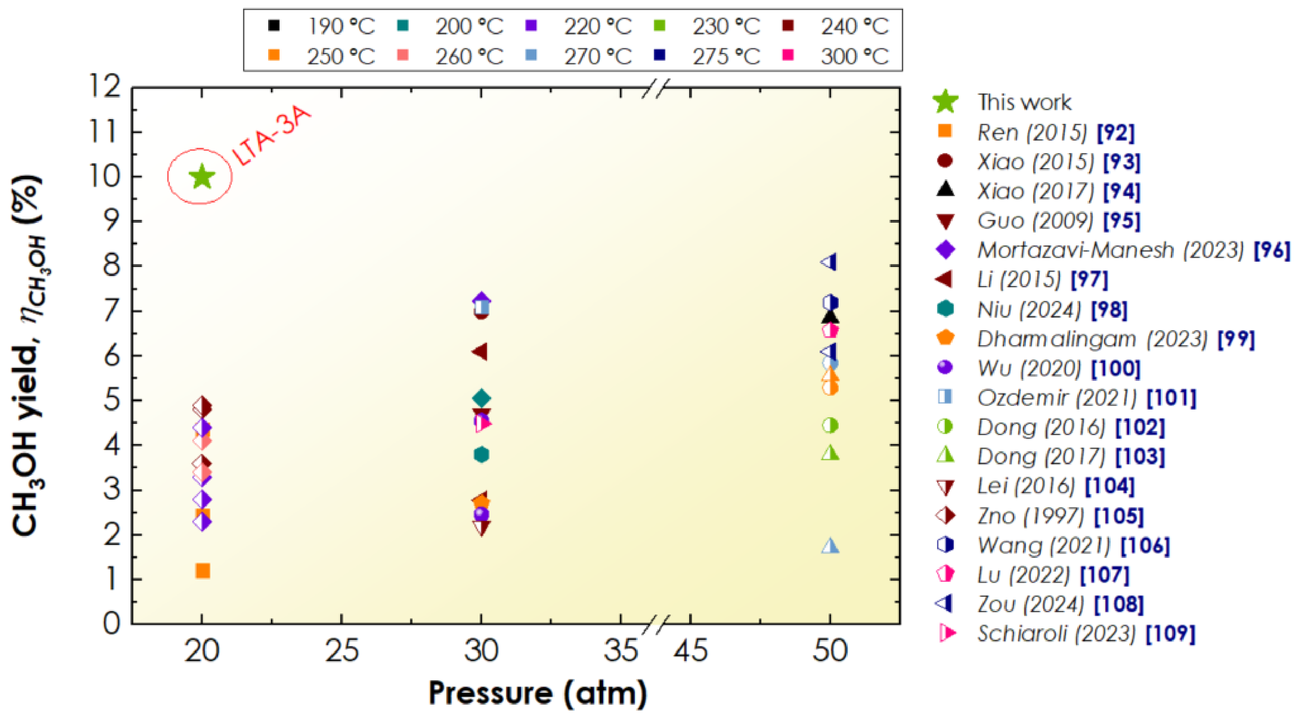

Figure 4. CH_3OH yield as a function of pressure P. This work represented with stars. Data compiled from literature with different symbols and colours. (Extracted from [2])

Conclusions

- **SER** enabled **CO_2 hydrogenation** beyond **thermodynamic equilibrium**, highlighting its **potential** as an effective process intensification strategy
- **Continuous process intensification** was successfully achieved through the integration of a fluidized-bed reactor with continuous sorbent feeding (**SEFBR+CSF**)
- **Fixed-bed Sorption-Enhanced** operation substantially **boosted** both **CO** and **CH_3OH production**, outperforming the conventional process.

References

[1] González-Pizarro, R., Lasobras, J., Renda, S., Soler, J., Menéndez, M., & Herguido, J. (**2026**). Overcoming Thermodynamic limitations of the LT-rWGS in a Sorption Enhanced Fluidized Bed Reactor with Continuous Sorbent Feeding (SEFBR+CSF). SSRN Electronic Journal. https://doi.org/10.2139/ssrn.6020407

[2] González-Pizarro, R., Calero-Berrocal, R., Lasobras, J., Renda, S., Rodríguez-Pardo, Soler, J., Menéndez, M., and Herguido, J. (**2025**). Tuning e-fuel selectivity in sorption-enhanced CO_2 hydrogenation over In_2O_3/ZrO_2: The effect of LTA and FAU zeolites. Fuel 406, 136974. https://doi.org/10.1016/j.fuel.2025.136974.

Acknowledgements

Financial support from Agencia Española de Investigación (PID2022-139819OB-I00), with financial support from the European Union "NextGeneration EU"/PRTR and European Union Fund for Recovery and Resilience, as well as the financial support of the Catalysis and Reactor Engineering Group (CREG, T43–23R) from Gobierno de Aragón through the European Social Fund – FEDER are gratefully acknowledged.

R. González-Pizarro wants to express his gratitude for the research grant of Ministerio de Ciencia e Innovación of the Spanish Government (PRE3023-UZ-26).