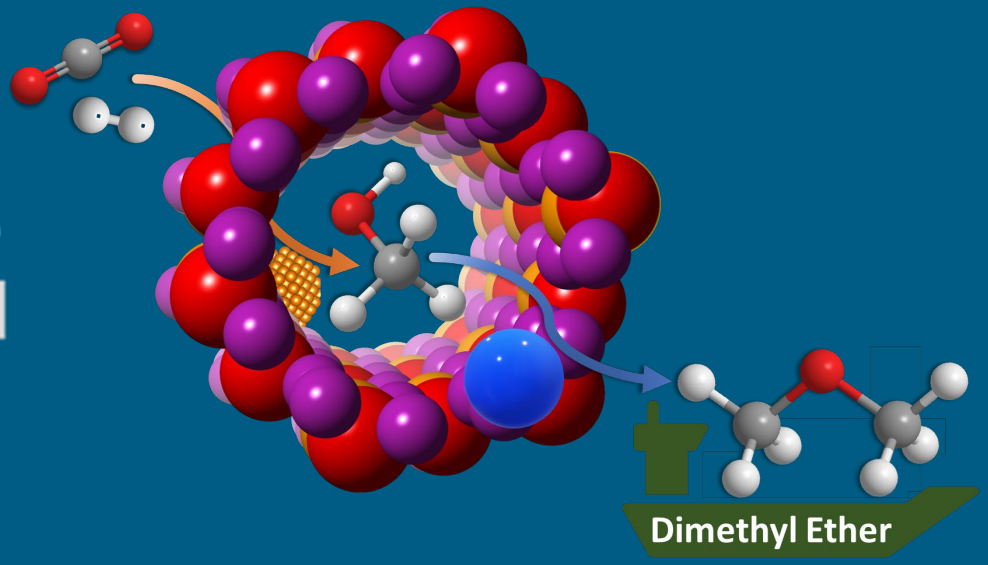
Converting CO_2 to Sustainable Marine Fuels Using Cascade Nanoreactors

Maciej Walerowski, Lindsay-Marie Armstrong & Robert Raja

STEM for BRITAIN



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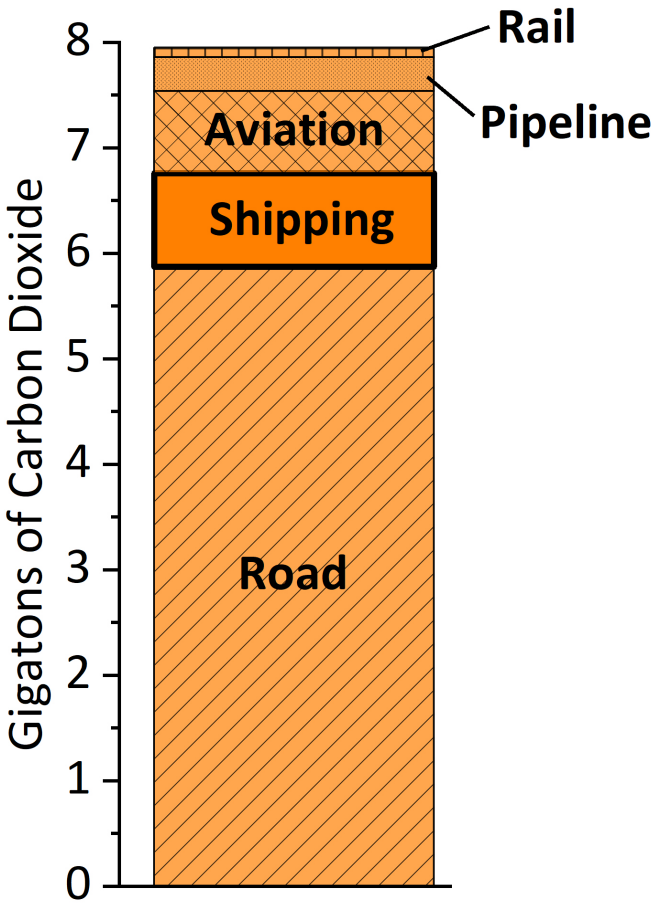
1 Decarbonising Marine Shipping



Shipping responsible for ***3% of global CO_2*** emissions

Challenging to electrify long haul maritime shipping

Vehicle and duty cycle compatibility		Synthetic fuels	Electricity
Heavy-duty truck			
Aviation	Short haul		
	Long haul		
Marine	Short journey		
	Long journey		
Refuelling and distribution challenge			

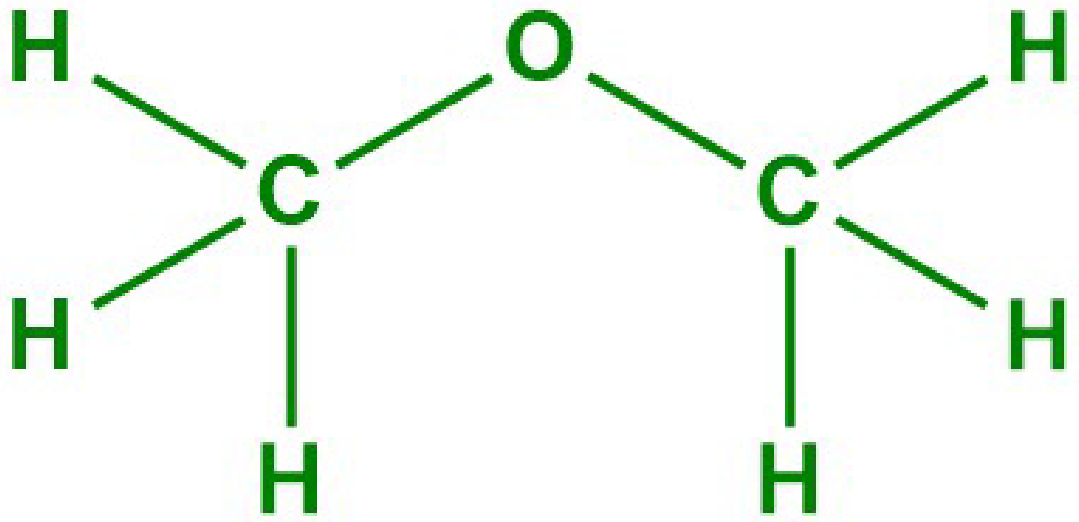
Require alternative & ***sustainable fuels***

2 Dimethyl Ether as a Sustainable Marine Fuel

Compatible with existing ***LPG infrastructure***

Non-toxic

Non-corrosive

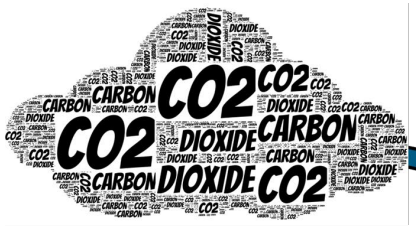


Burns efficiently

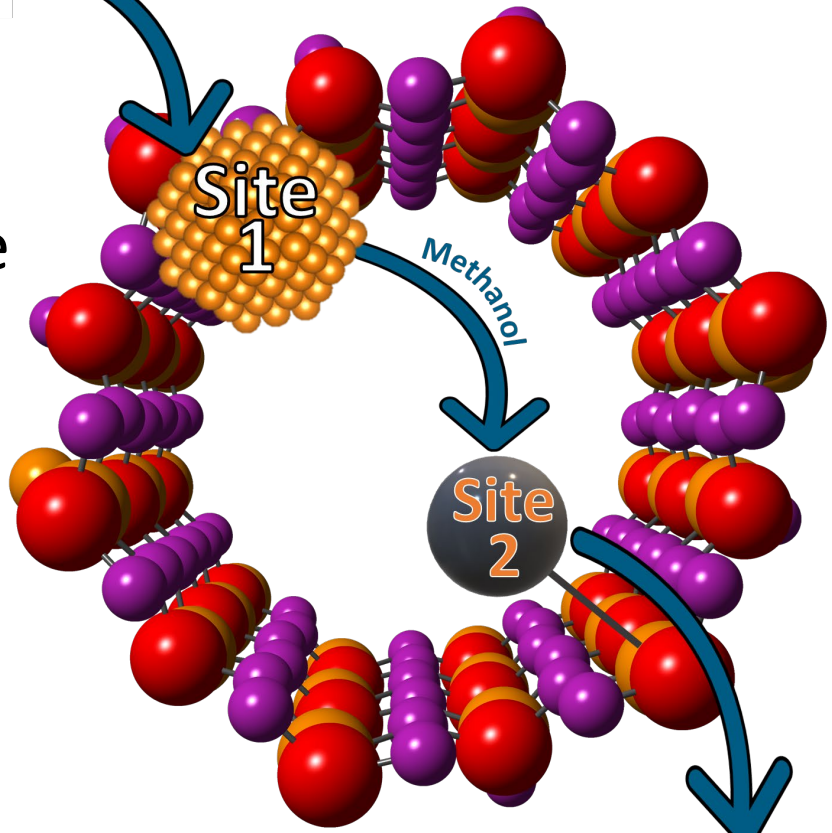
Producible from CO_2 via a circular carbon economy

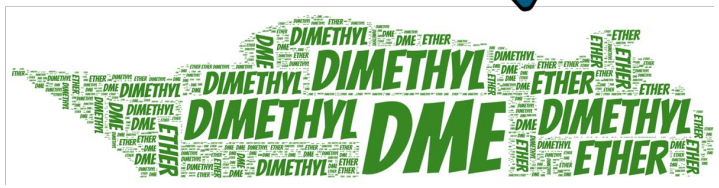
^{12}C

3 Cascade Nanoreactors for Dimethyl Ether Synthesis



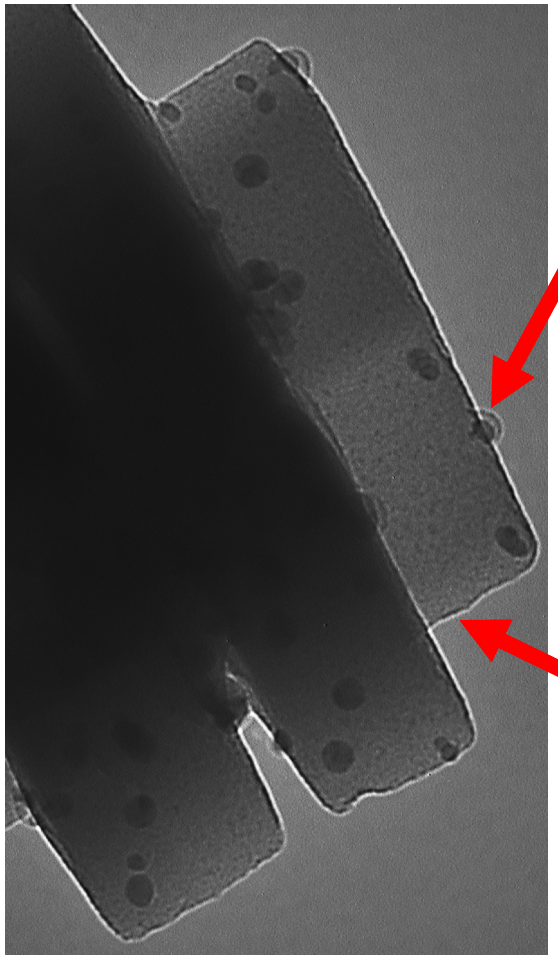
Convert CO_2 to DME in one reactor via a methanol intermediate using a cascade nanoreactor ***(reaction enabler)***





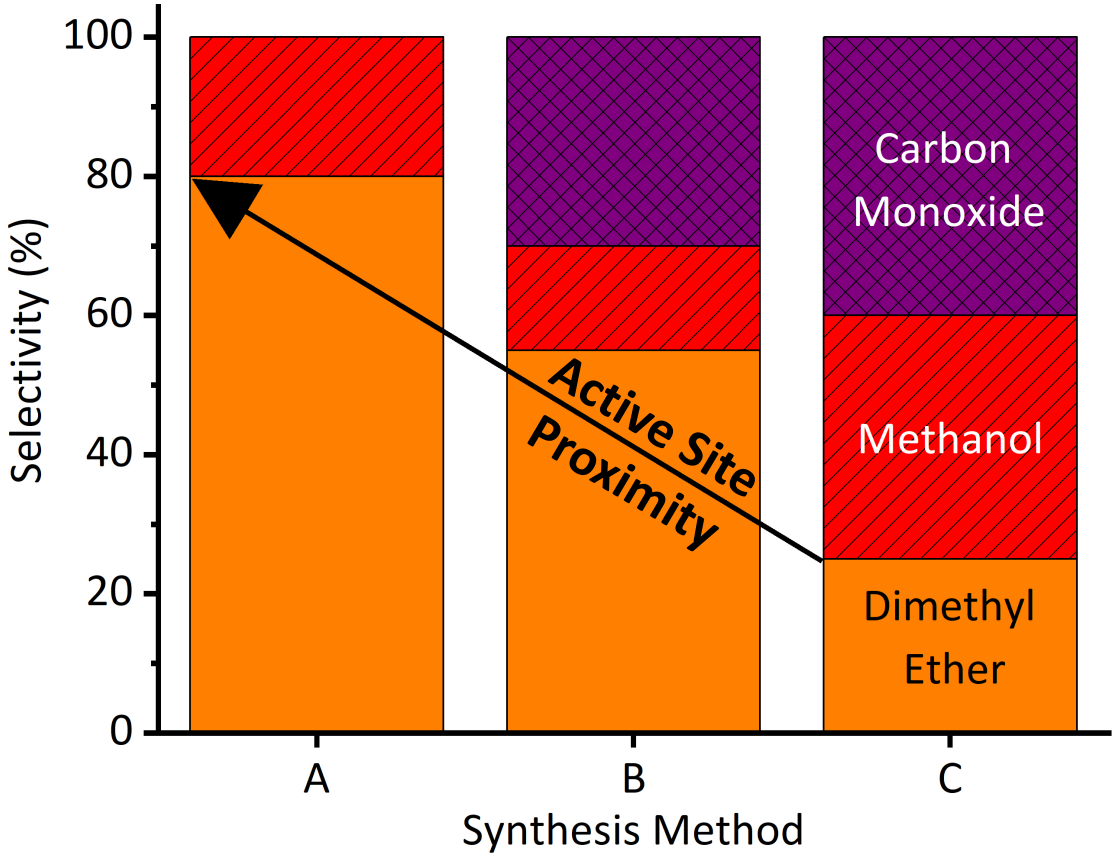
Bifunctional cascade nanoreactor requires ***two active sites*** (Site 1 & Site 2)

4 Cascade Nanoreactors for Dimethyl Ether Synthesis



Site 1 close to Site 2 on a support

Tailor synthesis to ***adjust active site proximity***



Bringing Site 1 & Site 2 closer together: ***higher DME selectivity*** (less waste) & no toxic CO formation

5 Summary & Outlook

- Dimethyl Ether is a sustainable, ***alternative marine fuel***

- Bifunctional cascade nanoreactors with ***nearby active sites*** can convert CO_2 to DME in one reactor with no toxic by-products

2021

2030

Our highly selective cascade nanoreactor could be used in a ***rapidly growing market***

Thank you for listening! Any questions?

Maciej Walerowski, Lindsay-Marie Armstrong & Robert Raja

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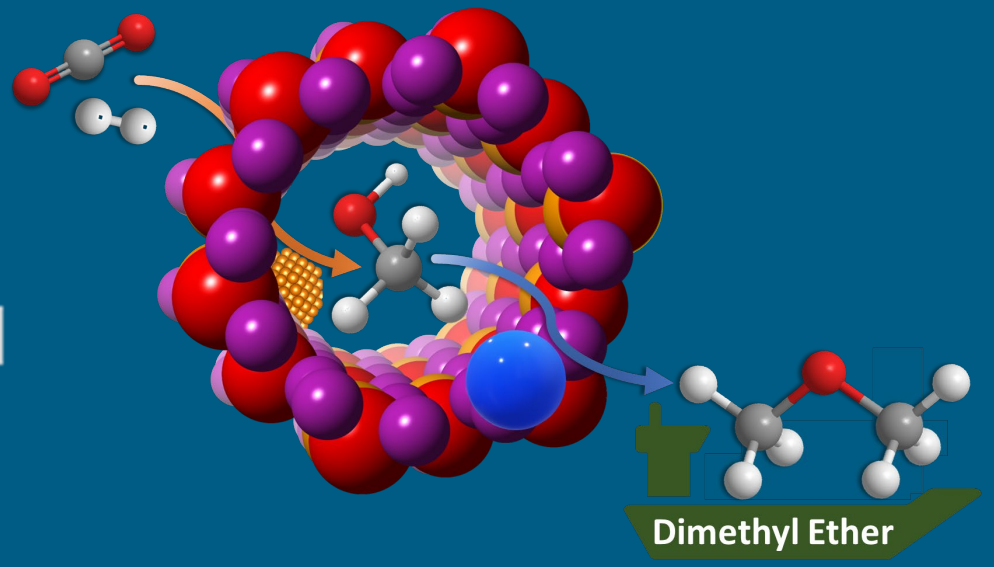

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