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Ceramic proppant design for in-situ microbially enhanced methane recovery

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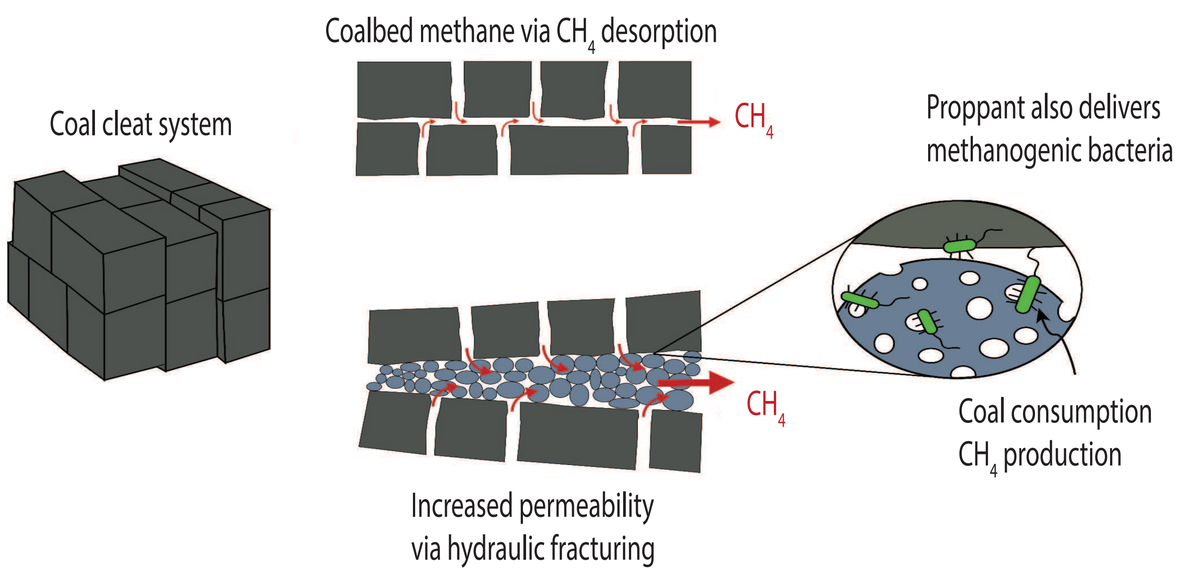
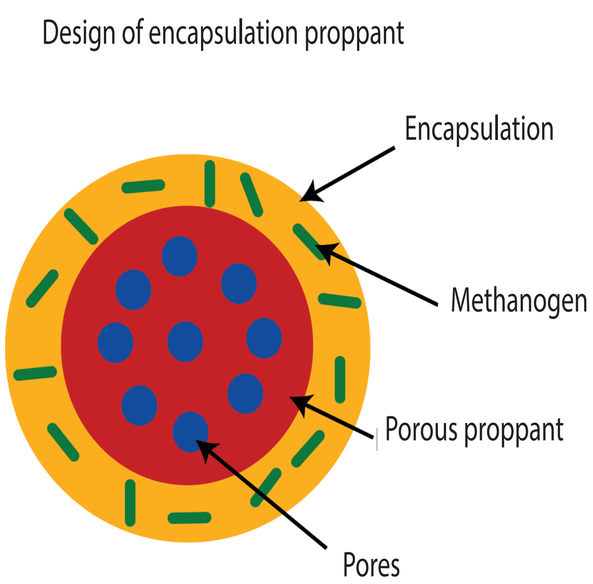
Introduction

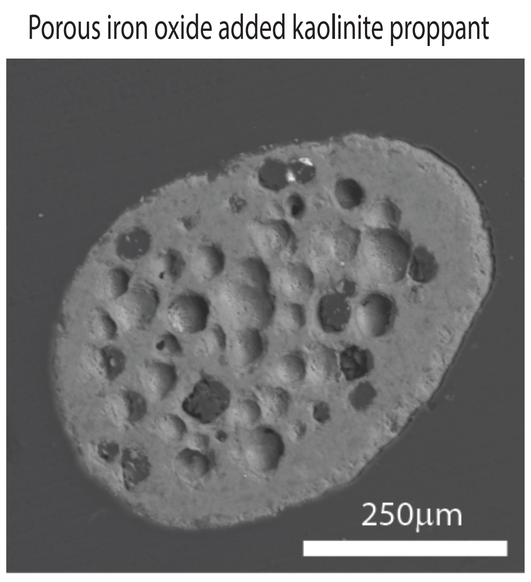
A ceramic proppant and fluid are delivered together to keep an induced hydraulic fracturing open. This study is the methanogenic microbial consortia, transported to enhance coal seam permeability. We redesigned the vehicle to be ultralight weight and encapsulated both vehicle and consortia. As a result, the encapsulation system released the microbes and successfully produced the methane gas in-situ.

Microbes can be used to enhance coalbed methane recovery.
Microbes can consume coal reservoir/remove coal fines to generate more methane and to enhance conductivity.

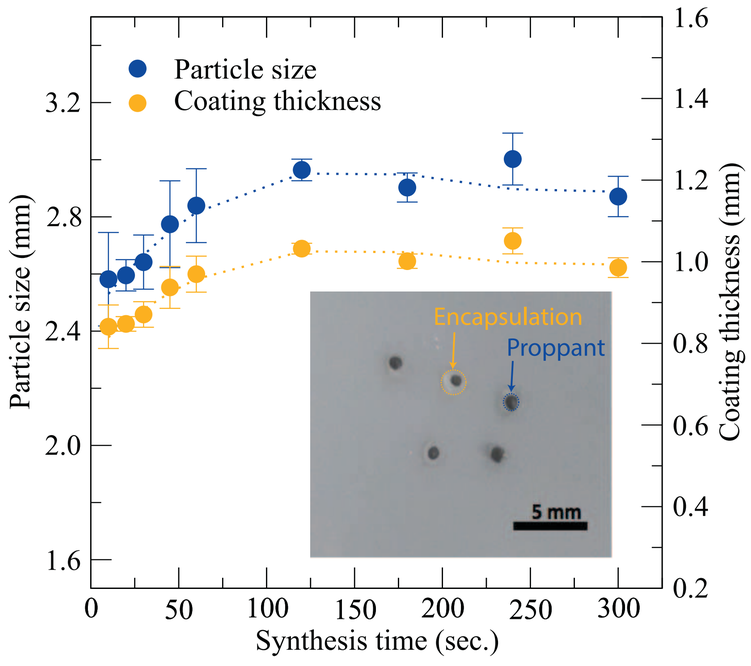


Polymer encapsulated methanogen and ultralight ceramic proppant.
Methanogens are encapsulated by polymer and the core of particle contains porous ultralight ceramic proppant.

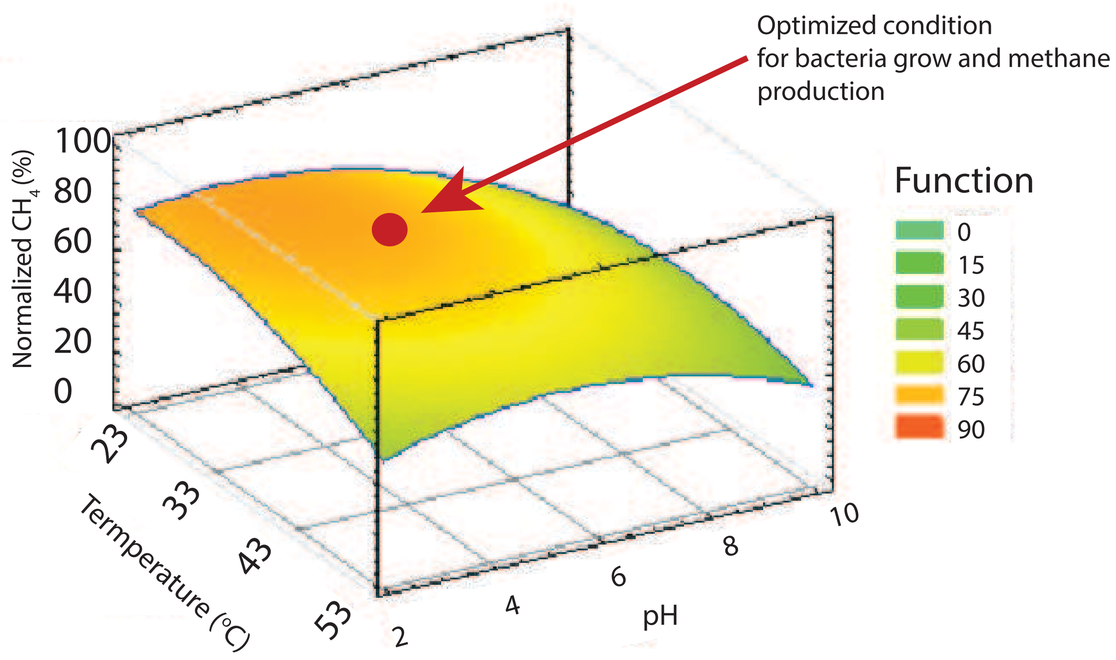




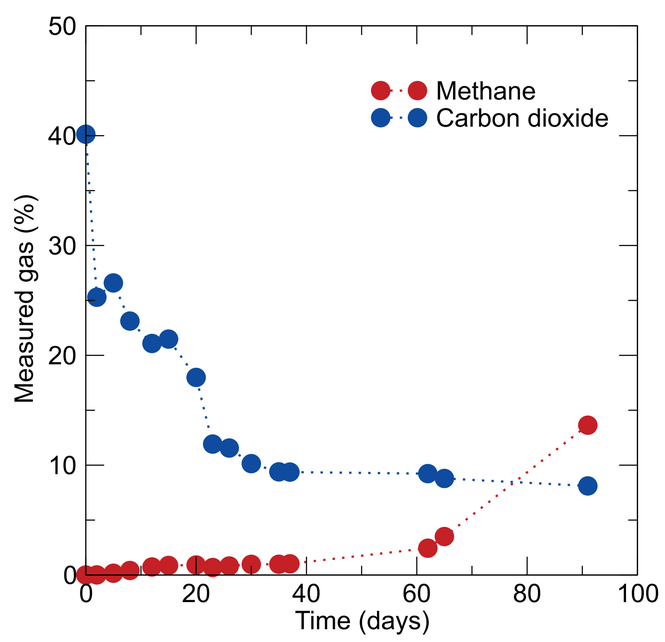
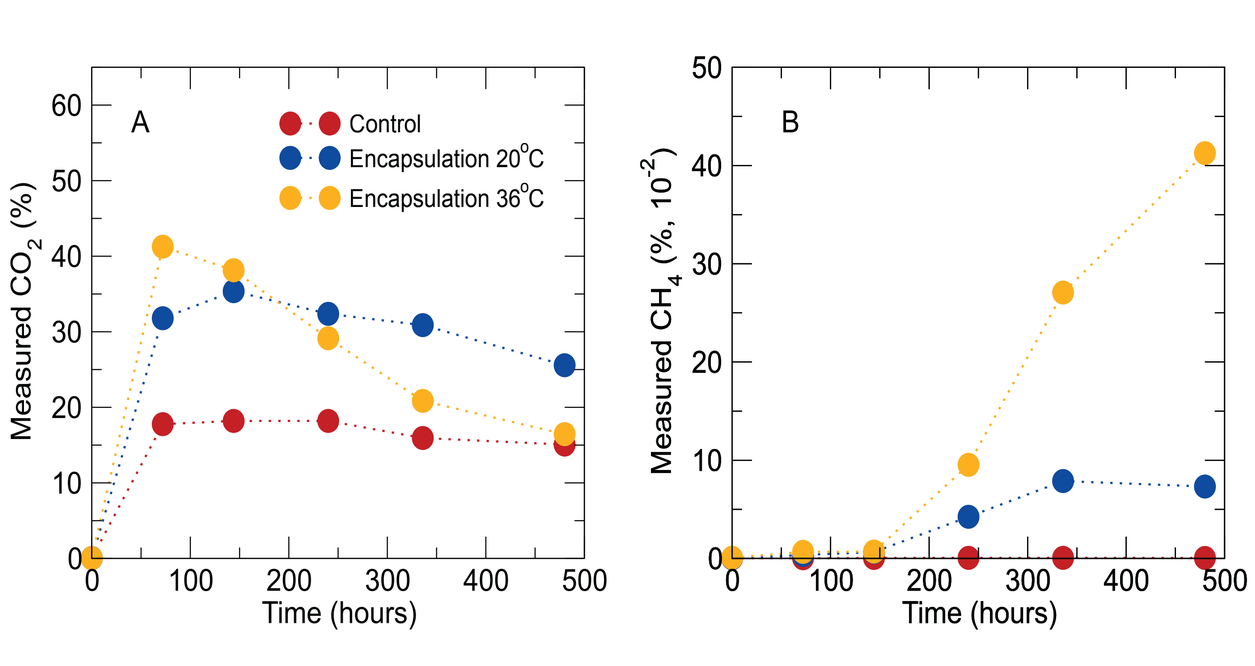
Calcium-alginate polymer encapsulated ceramic proppant and methanogens.
The encapsulation thickness was controlled by the reaction time. The total diameter of particle was limited to ~2.9 mm over 2 minutes



Methanogens for encapsulationa are grown in the optimized condition by simulation.
The maximum methane gas was produced at low pH and 36°C conditions.



Methane and carbon dixoide production from coal in the optimized condition.
The coal was optimized to grow the bacteria at 36°C, low salinity, and pH 5.5. Methane gas production became greater at Day-90 than carbon dioxide.



Methanogens, released from encapsulation, produced methane and carbon dioxide gases.
The methane gas was produced over about 20 days while consuming carbon dioxide.