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SOLAR RECYCLING OF CO_2 TO FUELS

Sandia National Laboratories SAND2010-1611P

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S2P SUNSHINE PETROL

Motivation

To re-energize CO_2 and H_2O into hydrocarbon fuels using concentrated solar energy at an **unprecedented, "game-changing" life cycle solar-to-fuel energy efficiency of 9%**

To store solar energy in an easily distributed and portable chemical form

To enable fungible, infrastructure compatible, drop in hydrocarbon fuels (gasoline, diesel, jet fuel) at an efficiency that could scale with modest land usage and available solar resources

Solar-to-Fuels Cycle

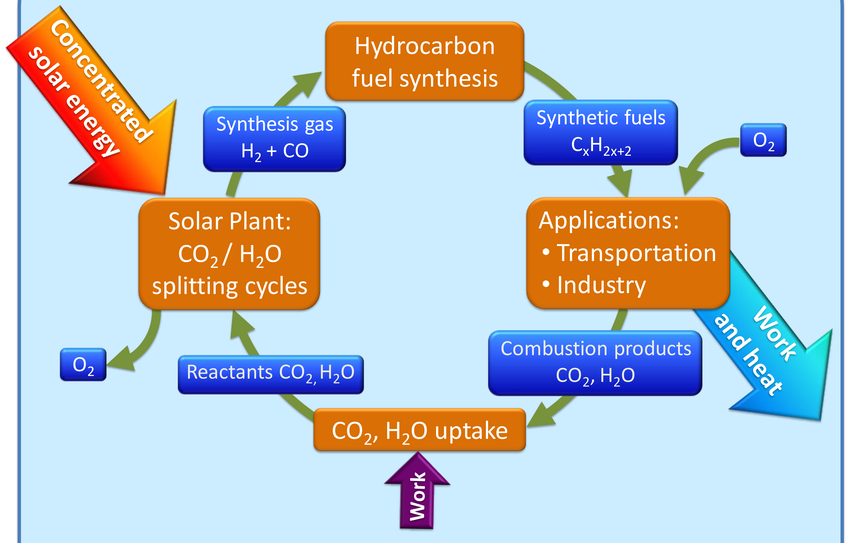

Fig 1. The solar-driven technology produces fungible synthetic fuels by recycling products of combustion. It is highly-scalable, sustainable, and utilizes the existing fuel distribution infrastructure.

Solar-Driven Chemical Heat Engine Technology

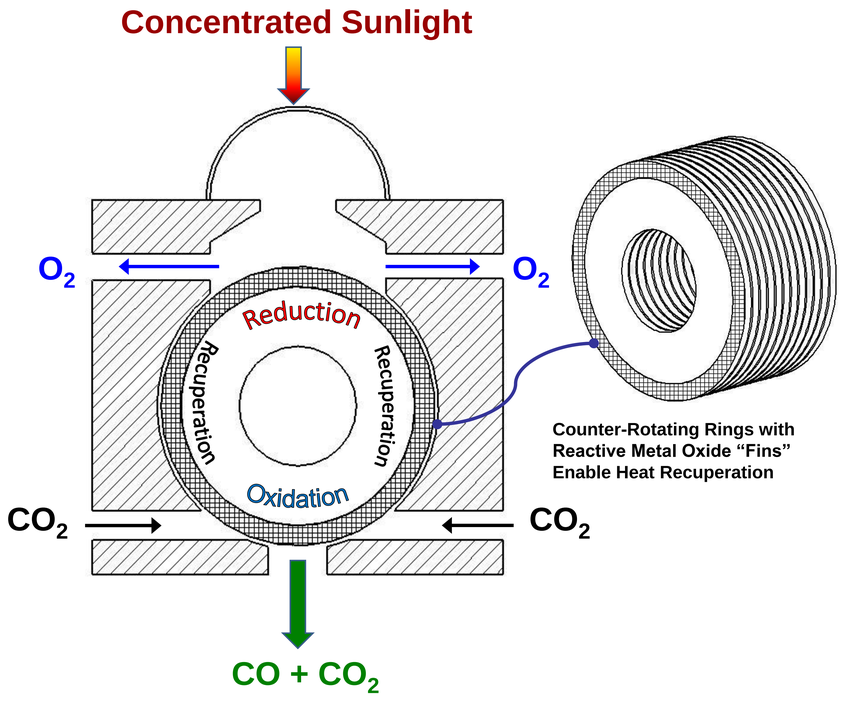

Fig 2. CR5 chemical heat engine prototype for CO_2 and H_2O splitting (shown for CO_2). High utilization of reactive structures and heat recuperation contribute to an anticipated 20% solar-to-chemical conversion efficiency. Our goal is to develop and demonstrate an advanced 9 kW_{th} heat engine.

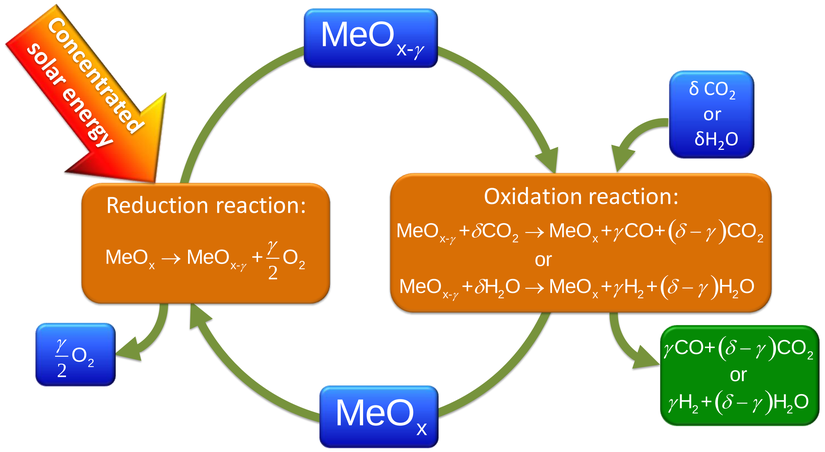

Fig 3. The CR5 cycles a metal oxide between an irradiated reduction zone (higher temperature) and the dark oxidation zone (lower temperature).

Impact

Demonstration will lead to a new energy related application enabling renewable production of synthetic hydrocarbons that have properties equivalent to what we are deriving from petroleum today

Research and development will lead to improved performance, enhanced durability, increased reliability of the engine, and reduced cost

Solves the intertwined problems of accelerating energy demand, dwindling supplies, lack of domestic energy security, and climate change while utilizing much of the existing infrastructure.

Acknowledgements

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