

Formation of Synthesis Gas Using Solar Concentrator Photovoltaics (SCPV) and High Temperature Co-electrolysis (HTCE) of CO₂ and H₂O

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Carbon dioxide is considered a greenhouse gas (GHG) that reflects solar radiation and consequently increases the temperature of the earth. Many countries are now considering putting a tax on CO₂ emissions that will increase the cost of products that are associated with those emissions. The most common method currently considered for dealing with CO₂ emissions is the capture of the gas, pressurization, and then sequestration in either rock formations or saline aquifers. This is relatively costly in both capital investment and operation of the equipment. Also, there is the possibility that this CO₂ will escape at some point in the future subjecting the company in question to an uncertain risk.

Ceramatec has been investigating an alternative approach that converts the CO₂ into a useful product that can then be sold. Using the solid oxide fuel cell materials set in conjunction with a non-carbon source of energy it is possible to generate synthesis gas (CO and H₂) and oxygen from CO₂ and H₂O. SCPV systems are the most efficient generators of solar electricity and generate high quality heat at the same time. HTCE uses both the solar electricity and the heat to electrolyze the CO₂ and H₂O at double the efficiency of traditional electrolysis. The synthesis gas that is produced can be used to produce synthetic fuels such as synthetic natural gas or Fischer Tropsch liquid fuels.

This paper will discuss this alternative approach to the disposal of CO₂. This approach has the following advantages: permanent disposal, usable product, storage of solar energy in fuel, reduction of GHG, reduction in solar radiation, and no additional GHG. The paper will discuss the application of the technologies, results of tests conducted to date, and the economics of the technology versus alternative approaches.