Reactwell, L.L.C.
1441 Canal Street
Laboratory 301
New Orleans, LA 70112-2714 USA

Single Step Electrochemical Process for Conversion of CO2 to Ethanol

Among the many proposed CO_2 mitigation strategies, recycling is a compelling option that is largely not performed outside of enhanced oil recovery, given the fundamental technologies needed to recycle CO_2 into useful chemicals are scarce. Moreover, the energy inputs necessary to chemically reduce carbon from the fully oxidized CO_2 into a hydrocarbon are significant, and unlikely to be economical using baseload electricity. A process that can utilize surplus electricity that would otherwise be curtailed to produce useful products from CO_2 would be very desirable and useful.

Researchers at ORNL and Reactwell have developed said process for converting CO_2 to ethanol by introducing CO_2 onto a sequential catalyst comprised of carbon nanospikes and copper nanoparticles. Together these react electrochemically with the CO_2 in the form of bicarbonate, producing ethanol. The process can be operated as a dispatchable load, which can match the intermittency of renewable sources such as wind and solar. A technology like this is a useful alternative to batteries for long term or portable storage of renewable electricity. Dr. Adam Rondinone and their team at ORNL and Reactwell have been conducting studies to scale the technology for industrial consumption as well as to understand efficiency limits, lifetime limits, poisoning tolerance, and provide for other potential improvements. The team has already demonstrated that the carbon nanospikes which form the basis of the catalyst are electrochemically stable for at least 300 hours and can be grown on a variety of substrates over wide areas necessary for industrial scale.

Because of these advantages and the simplicity of the reaction compared to other ethanol sources, this discovery has attracted enormous interest from around the world including greater than 400 media mentions, programmatic interest, and dozens of potential licensees and investor inquiries. After thorough review the firm Reactwell was select as commercialization partner, which subsequently hired co-inventor and has since with innovations from both teams developed additional patents in the portfolio. The catalyst is novel primarily because of the nanotextured surface, and it is the first to achieve this high level of performance, but it should be noted that fundamental research of electrochemical CO_2 reduction has been ongoing for more than 40 years. Most of that research is focused on textured bulk copper, with another significant paper describing nanoparticle copper on glassy carbon.

Integrating the novel nanospike catalyst into electrochemical systems and scaling-up catalyst manufacturing is under progress with a world's first single step electrochemical solar ethanol field deliverable.

Reactwell, L.L.C. was founded in 2011 and headquartered in New Orleans, LA. Started in a cubical, then rented a lab bench, then two lab benches, then a dedicated laboratory, followed-up by an advanced prototyping center and then acquired property for larger scale-up of electrochemical based technologies.