Reactor uses sunlight to make hydrocarbon fuel

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Researchers have developed a reactor that can rapidly produce fuel from sunlight, using carbon dioxide and water, plus a compound called ceric oxide.

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These compounds in turn can be stripped of their oxygen, either through thousands of years of underground degradation to yield fossil fuels, or through a rather more rapid process of dissolution, fermentation and hydrogenation to yield biofuels.

Yet right now, converting sunlight into a chemical fuel isn't the most effective process, and practical generation of solar fuels remains a long way off.

Researchers have recently been exploring alternative possibilities of using sunlight to turn carbon dioxide into hydrocarbon fuel without relying on the intervening steps of plant growth and breakdown.

William Chueh and colleagues now demonstrate one possible reactor design, in which concentrated sunlight heats ceric oxide—an oxide of the rare earth metal cerium—to a high enough temperature to shake

loose some oxygen from its lattice.

The material then readily strips oxygen atoms from either water or carbon dioxide to replace what's missing, yielding hydrogen or carbon monoxide (which in turn can be combined to form fuels using additional catalysts).

With a windowed aperture through which concentrated sunlight enters, the solar-cavity reactor is designed to internally reflect light multiple times, ensuring efficient capture of incoming solar energy.

Cylindrical pieces of ceric oxide sit inside the cavity and are subjected to hundreds of several heat-cool cycles to induce fuel production.

The study was published last week in the journal *Science*.

More information: "High-Flux Solar-Driven Thermochemical Dissociation of CO2 and H_2O Using Nonstoichiometric Ceria," by W.C. Chueh; M. Abbott; D. Scipio; S.M. Haile at California Institute of Technology in Pasadena, CA; C. Falter; P. Furler; A. Steinfeld at Eidgenössische Technische Hochschule (ETH) in Zurich, Switzerland; A. Steinfeld at Solar Technology Laboratory, Paul Scherrer Institute in Villigen, Switzerland. *Science*, January 2011.

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