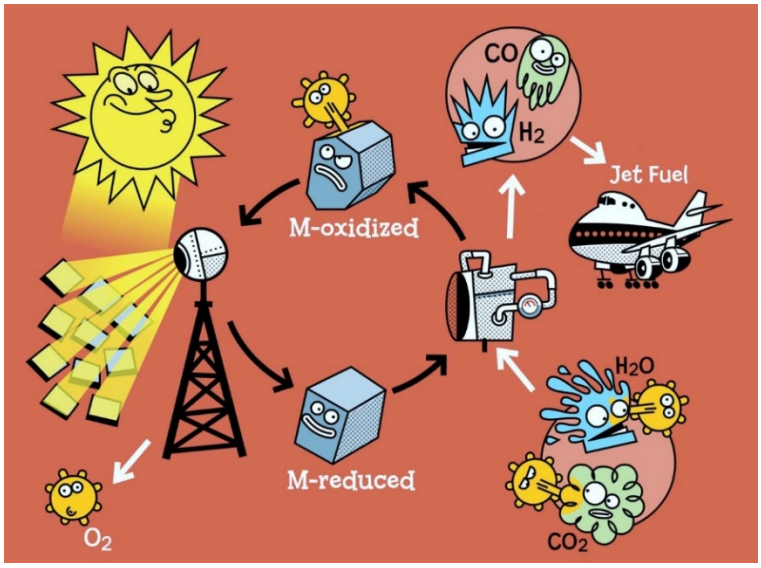
UNIVERSITÀ DEGLI STUDI DI BRESCIA

Drop-in Transportation Fuels from H_2O, CO_2, and Solar Energy

Aldo Steinfeld

Department of Mechanical and Process Engineering, ETH Zurich, 8092 Zurich, Switzerland



Abstract – The entire production chain for renewable drop-in fuels obtained directly from sunlight, H_2O, and CO_2 has been experimentally demonstrated. The key component of the production process is a solar reactor containing a reticulated porous ceramic (RPC) structure made of ceria, which enables the splitting of H_2O and CO_2 via a 2-step thermochemical redox cycle. In the 1st endothermic reduction step, ceria is reduced using concentrated solar radiation as the energy source of high-temperature process heat. In the 2nd exothermic oxidation step, nonstoichiometric ceria reacts with H_2O and CO_2 to form H_2 and CO – syngas – which is finally processed to kerosene and methanol. The RPC features dual-scale porosity for enhanced heat/mass transport and rapid redox kinetics, while 500 consecutive redox cycles further validate material stability and structure robustness. Solar experimental runs with 3000x suns flux irradiation yielded full selectivity, high molar conversion, and 5.25% solar-to-fuel energy efficiency.

Biographical sketch – Aldo Steinfeld (PhD University of Minnesota, 1989) is Professor at the Dept. of Mechanical and Process Engineering of ETH Zurich, where he holds the Chair of Renewable Energy Carriers. He served as the Head of the Institute of Energy Technology from 2005–2007 and Associate Head of the Department of Mechanical and Process Engineering from 2007–2009. He has authored more than 300 refereed journal papers and filed 30 patents. His contributions to science and education have been recognized with the ASME Rice Award (2006), the Yellott Award (2008), the European Research Council Advanced Grant (2012), the ISES Farrington Daniels Award (2013), the Heat Transfer Memorial Award (2013), and the ASME Kreith Energy Award (2016). Prof. Steinfeld is member of the Swiss Academy of Engineering Sciences. www.prec.ethz.ch

Martedì 25 Giugno, Aula Consiliare Ingegneria, via Branze 38 , Brescia

Contatti: Ivano Alessandri ivano.alessandri@unibs.it

Fondi di Ateneo per Attività a Carattere Internazionale