Eidgenössische Technische Hochschule Zürich
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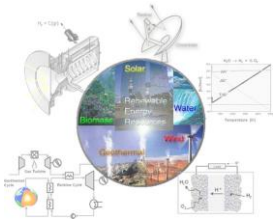

Seminar PRE
March 12, 16:15, ML-J26

PROGRESS IN SYNTHETIC FUEL PRODUCTION USING SOLAR ENERGY

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An important and challenging problem facing humankind is the development of methods for low-cost production of potent fuels, which can be made and used abundantly in intrinsically clean processes. Such processes must be safe, and have a zero net discharge of greenhouse gases or other pollutants and undesirable by-products.

Several research programs will be discussed:

First, the results of dry methane reforming with carbon dioxide in a directly irradiated receiver seeded with carbon black particles will be presented. No metal catalyst was used in the process, but the experimental results indicate that the methane decomposition rate is increased by the presence of the carbon black particles. The reaction between carbon dioxide and carbon black is faster than in previous documented literature. and the reaction rate does not seem to change if only carbon dioxide and carbon black are present in the receiver compared to experiments where methane is also part of the gas mixture. Initial results indicate that the high flux solar radiation may accelerate the reaction rate of methane decomposition. Yields of over 90% were measured with stoichiometric initial conditions (CH4/CO2 ratio of 1:1) when the gas exit temperature was about 1400°C.

Second, the experience with a new high temperature volumetric reformer, using a Porcupine type absorber will be discussed.

Finally, a new and promising synthetic fuel production approach using CO_2 – CO recycling will be described. In this process concentrated solar radiation is used for reduction of CO_2 to CO in a series of coupled energy conversion steps. The CO can then be used as a gaseous fuel in power plants or converted to a liquid fuel such as methanol. The CO_2 generated when the fuel is combusted would then be trapped and returned to the solar plant for recycling.