ISES Solar World Congress 2015

HIGH-TEMPERATURE THERMOCHEMICAL HYDROGEN PRODUCTION USING A SOLAR CONCENTRATING SYSTEM

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Abstract

The greatly insolated "sun-belt" regions include south-western United States, southern Europe, most of Australia, etc., where the direct normal irradiation exceeds 2000 kWh/m^2/year. The re-flection and concentration of direct insolation can be achieved by sun-tracking mirrors called heliostats. Some modern solar-concentrating systems, such as a parabolic dish, a central tower, and an advanced beam-down system, have concentration factors in 1000–5000 range and can provide high-temperature solar heat of 500kW_{th} - 100 MW_{th} or more. The concentrated solar radiation is focused upon a solar reactor where temperatures can reach 1500˚C. The high-temperature solar heat has the potential to produce fuels or hydrogen via thermochemical conversion processes, such as "solar multistep thermochemical water-splitting cycles", "solar gasification of coal/biomass", and "soar reforming of natural gas" [1, 2]. The lecture introduces our R&D activities on a novel beam-down solar concentrating system with a new "particles fluidized" solar receiver/reactor concept (Fig. 1) as well as recent R&D activities on the above solar thermochemical conversion processes in the world.

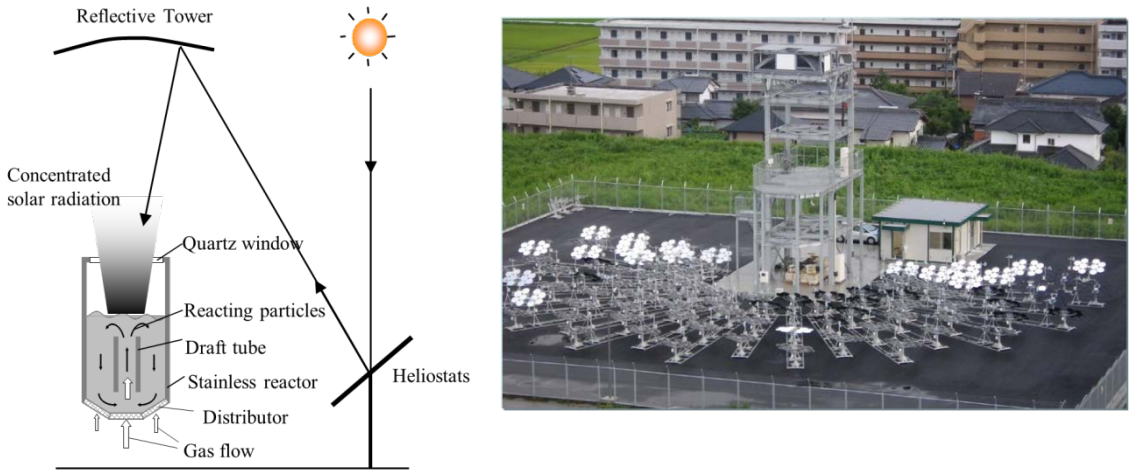

Fig. 1 Concept of solar thermochemical reactor with particles fluidized bed (left) and the novel beam down solar concentrating system for its demonstration (right).

Reference

1. T. Kodama, Progress in Energy and Combustion Science, 29, 567 (2003).

2. T. Kodama and N. Gokon, Chemical Reviews, 107(10), 4048 (2007).