

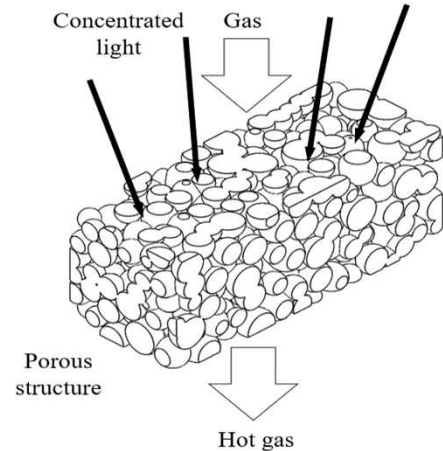
Project Name: International Joint Research and Development of Solar Concentrating Reactor for Carbon Dioxide Decomposition (2020–2023)

Entrusted parties: Niigata University, The University of Tokyo, Shinshu University



Outline of the project

Purpose: This international joint research studies a solar concentrating reactor for carbon dioxide decomposition based on highly efficient solar thermal receiver technology and a solar fuel production system using it. Integrated analysis and demonstration tests using real sunlight will be conducted for a prospective technology realizing solar-to-fuel energy conversion efficiency of 10% or more. A roadmap will be built for commercialization from FY2030 or later.



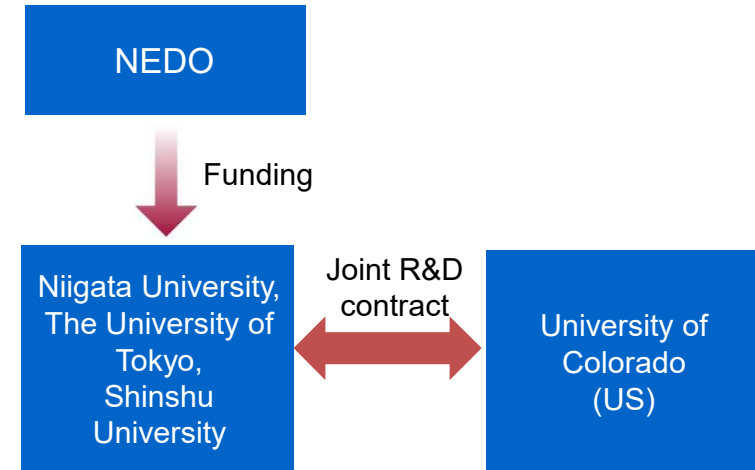
Highly efficient porous receiver

Specifically, the Integrated Analysis Tool will be developed with a combination of a detailed thermo-fluid simulation (The Univ. Tokyo) for microscopic heat and mass transport in porous structures, a continuum-model simulation (Niigata Univ.) for macroscopic phenomena of a whole concentrating reactor, and a system analysis (Shinshu Univ.) for an entire fuel production process. The integrated analysis and knowledge on reactive material (Univ. Colorado) will be used to optimize the system in order to achieve the target energy conversion efficiency for the whole system.

Significance of international R&D

- This research project will be conducted in collaboration with Prof. Alan W. Weimer at University of Colorado in Boulder.
- Prof. Alan W. Weimer developed active materials such as hercynite, perovskite, and ceria, and has vast experience conducting experiments on carbon dioxide decomposition using real sunlight. His experience and technological knowledge will be introduced into the integral analysis by three domestic universities for the early commercialization of carbon dioxide decomposition.

Project scheme



Expected outcomes

- Commercialization is targeted to start from FY2030 or later through research work using demonstration plants after this project.
- The construction of 20 MW of 10–20 solar CO₂ decomposition fuel plants is expected to reduce CO₂ emissions (CO₂ emissions reduction=390,00–780,000 tons-CO₂/year) and save energy (crude oil equivalent=230,000–460,000 kL-Oil/year).
- There are still challenges for efficient carbon dioxide decomposition for fuel production based on other renewable energies. The present technology will be highly competitive in this field.