Division of Environmental Studies

Department of Environment Systems

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Environmental Chemical Energy Engineering Laboratory	Dr. Junichiro OTOMO	Development of environmental-benign energy devices and systems is a crucial issue in terms of energy saving and reduction of CO2 emission. The research in Otomo laboratory focuses on electrochemical reaction, catalytic reaction and ionic conduction in solid electrolytes with the objective of integrating the elemental technologies into new chemical energy conversion devices and systems such as fuel cells, hydrogen production and energy storage systems. The integration of physicochemical phenomena with different scales is necessary to construct novel energy devices and systems. Thus, we are investigating the physicochemical (or electrochemical) phenomena through the perspective in molecular-scale, mesoscopic scale and macroscopic scale to solve some energy problems.	Chemical looping, reversible fuel cell, hydrogen, energy storage, technology assessment	Hydrogen production and energy storage systems are key technologies in terms of future energy systems combined with renewable energy. Chemical-looping (CL) and reversible fuel cell (r-FC) technologies are efficient energy conversion systems, and they attract attention as next generation energy supply and storage systems. To advance the systems, their technology assessments are required as well as experimental studies. In this project, the assessment of environmental impact and relevant experiment for CL or r-FC system will be investigated based on physicochemical properties of component materials and reactions.

Geosphere Environment Systems Laboratory	Dr. Tomochika TOKUNAGA	Underground geosphere environment has been extensively used to support highly developed human society; e.g., extraction of energy resources and groundwater, waste disposal, construction of tunnels and underground spaces. Because of these activities, environmental problems which affect the sustainability of our society have emerged. The target of our laboratory is to understand and predict the change of geosphere environment caused by human activities, and to develop necessary engineering measures to attain sustainable use of geosphere environment. Current research topics include, studying and evaluating geosphere environmental changes caused by energy resources development and proposing necessary technological measures for sustainable resources development, securing stable and safe freshwater resources and development of efficient management schemes, and modeling long-term fluid flow and material transport processes through geosphere and its application to waste disposal and energy resources exploration.	geosphere environment, coastal groundwater, natural resources management	Research topic: Analyzing natural and anthropogenic impacts on coastal groundwater systems by sandbox experiments and numerical simulations: About 70% of world's population live in coastal areas where groundwater is usually the primary source of freshwater. However, the freshwater-saltwater interactions in a coastal groundwater system is highly sensitive to variety of natural processes (e.g., tsunami disasters, climate change, tidal fluctuation, long-term transgression and regression) and human activities (e.g., groundwater abstraction, land reclamation, subsurface utilization). Understating the effects of natural and anthropogenic forcing on the dynamics of coastal groundwater systems can provide necessary information for the urban design/planning, sustainable managements of coastal resources, and protection of the coastal ecosystems. In this project, students will select one or several of natural/anthropogenic factors as the research target. The impacts of the selected factor(s) (e.g., tsunami disasters) on coastal groundwater systems will be studied by both laboratory sandbox experiments and numerical modelling. If necessary, field survey will be included in the activity. Students can obtain knowledge on the coastal hydrogeology, hands-on experience on building and operating experimental system, and skills on the numerical modeling approaches.