SHIKAZONO LAB.

[Solid Oxide Fuel Cell and Next Generation Heat Engines]

Integrated Research Center for Sustainable Energy and Materials

Thermal Energy Engineering

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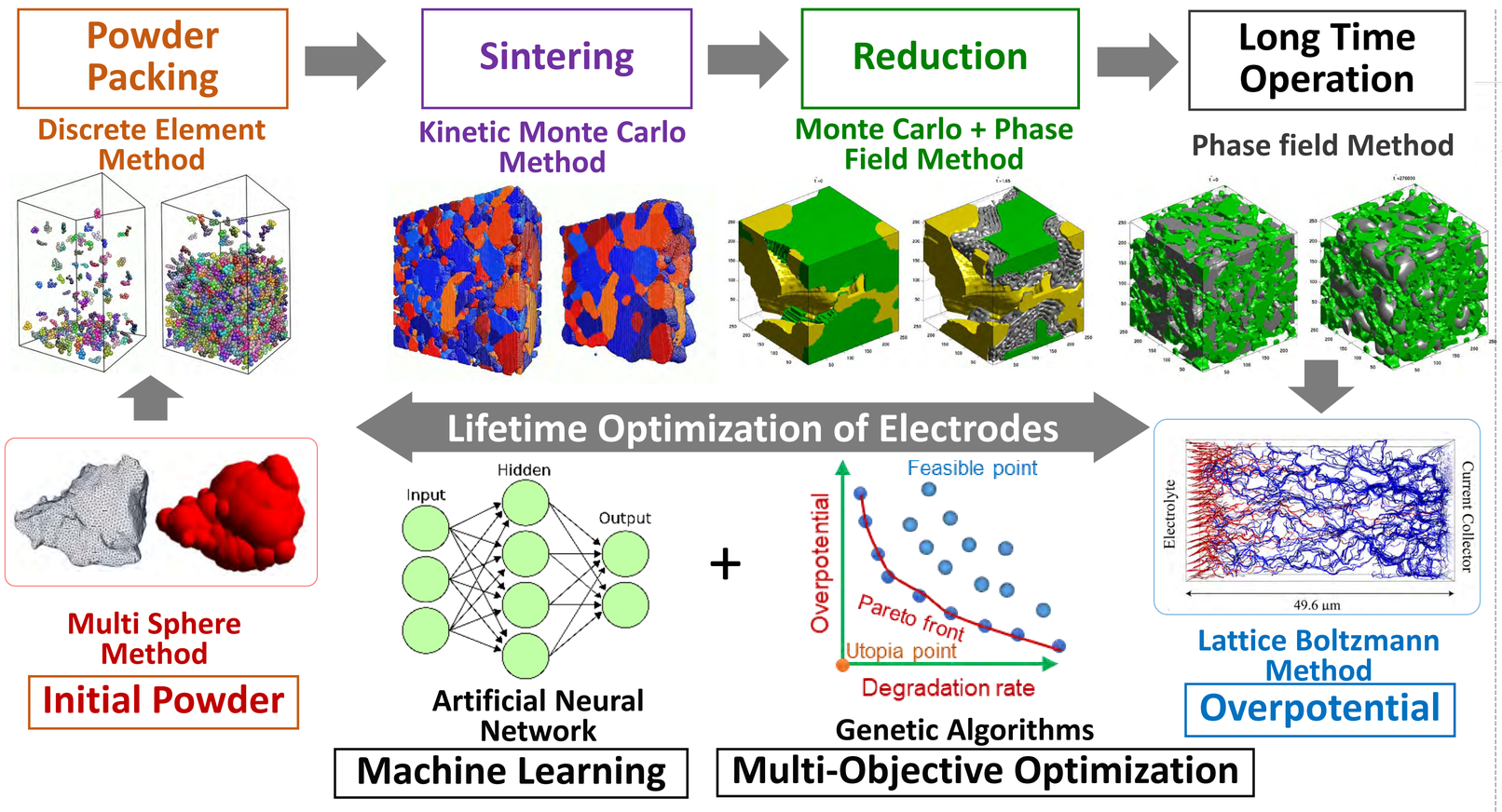
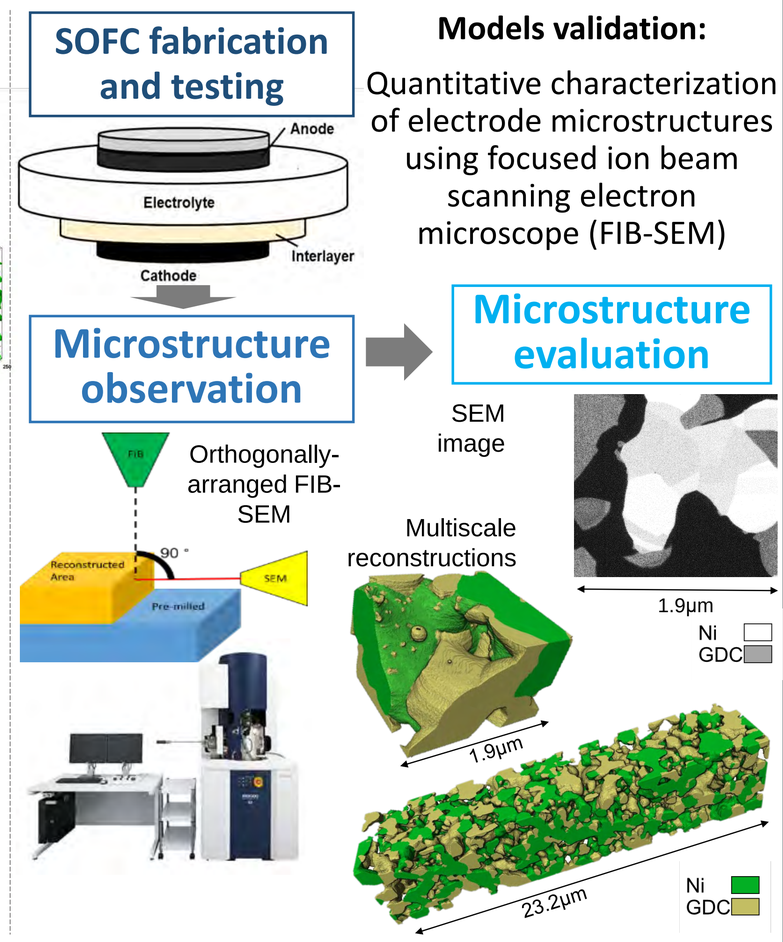
Polarization Characteristics and Microstructures of Solid Oxide Fuel Cell Electrodes

Electrode microstructures strongly affect the polarization characteristics of solid oxide fuel cells (SOFCs). Large-scale numerical simulation tools such as lattice Boltzmann, phase field, kinetic Monte Carlo and discrete element methods are developed to optimize the whole lifetime characteristics of the electrodes from initial powder to long time operation. Three dimensional microstructures reconstructed by FIB-SEM plays inevitable role for the model validation.





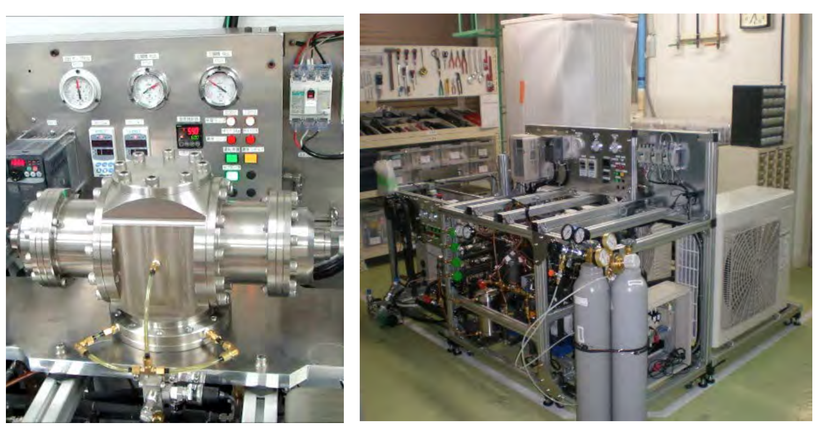
Models validation:

Quantitative characterization of electrode microstructures using focused ion beam scanning electron microscope (FIB-SEM)

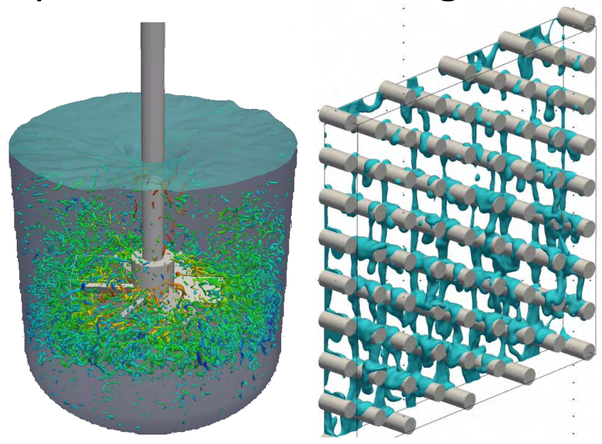
Next Generation Heat Engines

Efficient utilization of thermal energy has become even more important for the present energy systems. In order to reduce exergy loss, heat engines which operate at small temperature differences, and component technologies such as compact gas-liquid separators and compact heat exchangers are developed under collaboration with industry partners.

- Development of two phase expansion steam cycle
- Large-scale simulation and optimization using supercomputers
- Development of component technologies: heat transfer enhancement, compact gas-liquid separators, compact heat exchangers, etc.



Two phase expander & demonstration unit for trilateral cycle



High-fidelity simulation of liquid-gas two-phase flows

Compact gas-liquid separator

Compact finless heat exchangers