# N. Shikazono LAB.

## [Solid Oxide Fuel Cell and Next Generation Heat Engines]

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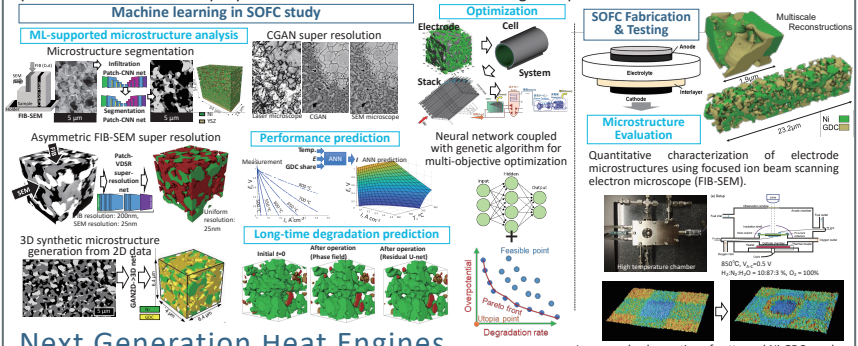
## Polarization Characteristics and Microstructures of Solid Oxide Fuel Cell Electrodes

Electrode microstructures strongly affect the polarization characteristics of solid oxide fuel cells (SOFCs). Machine learning, e.g. CNN and CGAN as well as large-scale numerical simulations 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 reconstruction by FIB-SEM and in operando observations play inevitable role for understanding the phenomena and model validation.

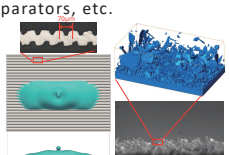



## Next Generation Heat Engines

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

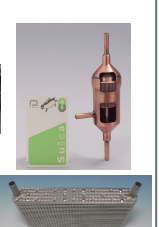
- Development of two phase expansion steam cycle (Trilateral steam cycle)
- Large-scale simulation and optimization using supercomputers
- Collaboration with material suppliers and manufacturing companies for novel heat exchangers and gas-liquid separators, etc.

Two phase expander & demonstration unit for Trilateral steam cycle



Numerical simulations and measurements of complex thermal systems

High performance anti-scale V-fins



Compact heat exchangers & gas-liquid separators