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.

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.